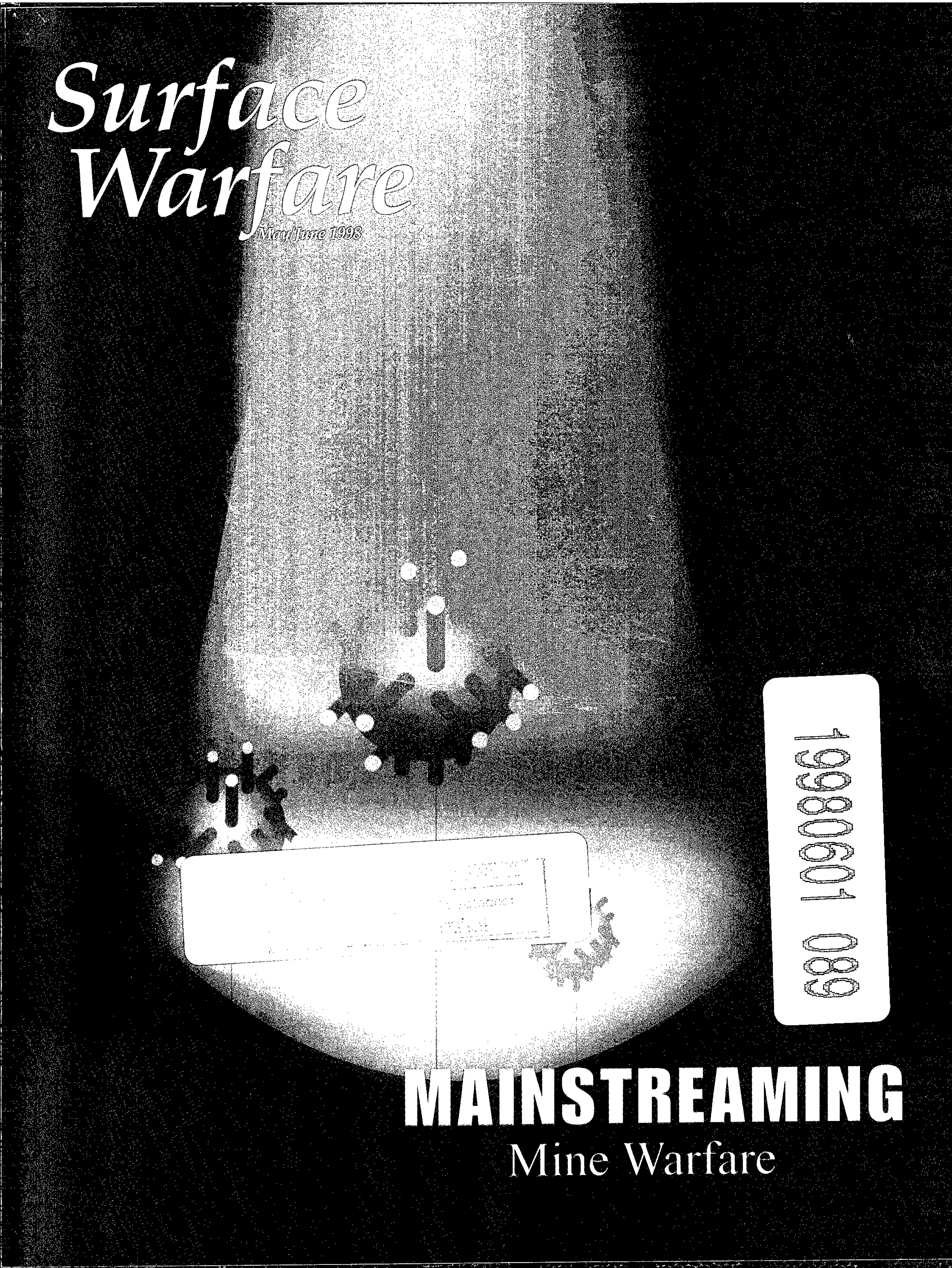
Surface Warfare

May/June 1998



MAINSTREAMING

Mine Warfare

Mainstreaming

This issue, which is the last to be published during my N86 tenure, focuses on mine warfare. Because there is nothing more essential to our survivability in the littoral, we are covering the subject in some detail. Maj. Gen. Ed Hanlon and his team in the Expeditionary Warfare Directorate have developed a mine warfare campaign plan that will inaugurate *organic* mine countermeasures in our combatants and submarines, even as we improve upon our *dedicated* mine countermeasures capability. This is not an abstract plan for the future: the changes are in effect now. For example, all DDG 51-class ships beginning with this year's contract award will contain remote mine hunting capability. Maritime dominance lays the foundation for our effectiveness in the littoral, and mine warfare underpins maritime dominance.

In a few weeks I will be relieved as Director, Surface Warfare. It has been a genuine privilege to assist in developing our transition to a 21st-century capability. Our construct of theater air dominance and land attack, based on a solid foundation of maritime dominance, has served us well in an increasingly difficult funding environment. The Surface Navy has a clear vision of its place in our Navy of the next century. Through the hard work of many, many people in OPNAV, the Navy Secretariat, the program executive offices, the systems commands, and joint and OSD staffs, we have converted the vision into an integrated family of programs. Theater ballistic missile defense, area air-defense commander capability, ERGM and the 5inch/62-caliber gun, VGAS, integrated undersea warfare, SH-60R helicopter, organic mine hunting, land attack Standard missile, LPD 17 and DD 21 — the 21st-century land attack destroyer — are all in place and funded. There is much left to do, of course. Bringing these programs to fruition will be a continuing challenge for our acquisition professional community, and there surely will be set backs along the way. But our direction is set, and support of the Navy leadership is strong.

Rear Admiral Mike Mullen, my relief, is no stranger to the work now under way. Prior to commanding the USS ***George Washington*** (CVN 73) Battle Group he served as the Deputy Director, N86. During his tenure he put into motion much of what has evolved into the surface warfare transition strategy. With Mike Mullen at the helm we can be fully confident of continued progress toward realizing the vision of offensive distributed firepower.

In closing my final letter I'd like to express my appreciation for the incredibly talented and hard-working N85/N86 team. These men and women have made, and will continue to make, a lasting contribution to surface warfare and our Navy. On behalf of surface warriors everywhere – thanks!

Dan Murphy

Daniel J. Murphy Jr.
Rear Admiral, U.S. Navy

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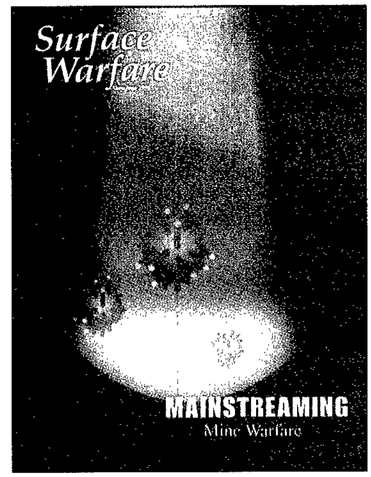
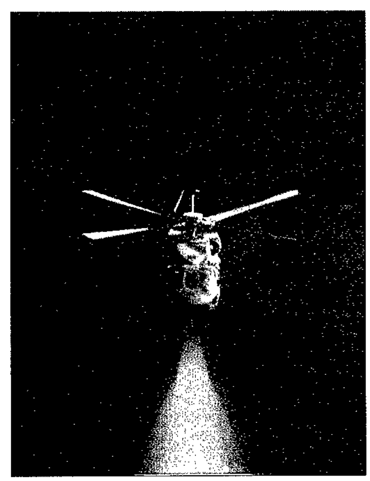
Vol. 23, No. 3



Cover: Mainstreaming Mine Warfare (*SikorskyAircraft Corp./A United Technologies Co.*)



Back cover: Mainstreaming Mine Warfare (*SikorskyAircraft Corp./A United Technologies Co.*)

Mines are quickly becoming the weapons of choice for many countries realizing, quite correctly, there is no point in trying to beat the U.S. Navy at its own game. For that reason, naval expeditionary forces can reasonably expect the already considerable problems created by naval mines to get worse long before they get better.

—Maj. Gen. Edward Hanlon Jr., USMC, Director, Expeditionary Warfare (OPNAV N85)

21st-Century Mine Warfare

THINK *or* SINK

On the morning of Aug. 5, 1864, Adm. David Glasgow Farragut stood on the bridge of the steamsloop USS ***Hartford*** readying his battle group for entry into the mined waters of Mobile Bay.

Farragut knew that Confederate Adm. Franklin Buchanan, embarked in the CSS ***Tennessee***, had strategically mined the channel, leaving only one point of entry for the Union ships but bringing them into direct fire from Fort Morgan's Confederate battery fire.

As the awesome line of battle steamed slowly into the mined channel, all hands nervously anticipated the potential explosion that might take their ship to the bottom.

One Union ship — USS ***Tecumseh*** — had already struck a mine. Its sinking forced the other Union ships to stop dead in the water, halting the Union naval advance. It was exactly as Adm. Buchanan had hoped. Realizing that precious time was being lost and seeing the tactical initiative slipping away, Farragut issued his famous order — "Damn the torpedoes! Go ahead — full speed!" This command spurred his captains to continue the assault despite the mine threat, culminating in a Union victory at Mobile Bay.

In littoral warfare, freedom of movement — strategic, operational and tactical mobility — is the most conspicuous advantage enjoyed by Navy and Marine Corps forces. Because naval expeditionary forces, and most of what they need to fight, travel by sea, they depend heavily upon this extraordinary capability. By capitalizing on this advantage, U.S. naval forces can appear and disappear, concentrate and disperse, exploit opportunities and avoid traps with astonishing rapidity. If this ability is compromised, the capability to operate in littoral waters will be greatly diminished and, in the worst case, *denied.*

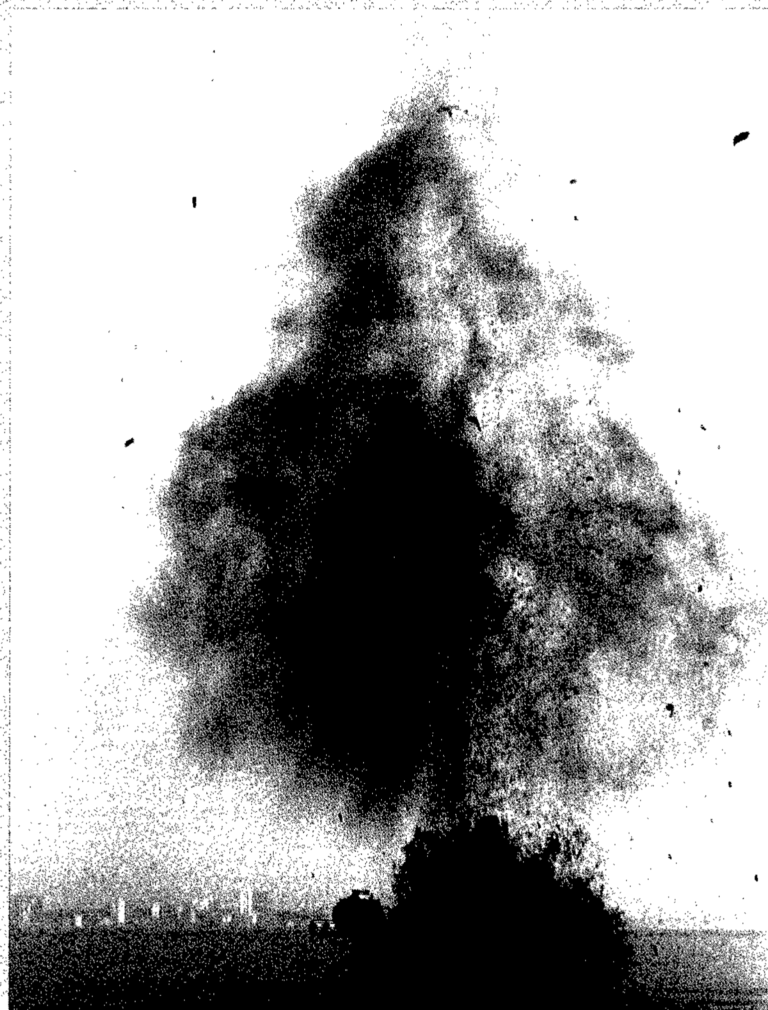
The great enemy of the freedom of movement of forces at sea is the naval mine, a weapon that has had a profound impact on naval operations in this century and is likely to be even more *wide*spread in the next. Approximately 30 nations manufacture naval mines that range from contact mines of the type used in World Wars I and II to weapons so sophisticated they might accurately be described as *seagoing robots.*

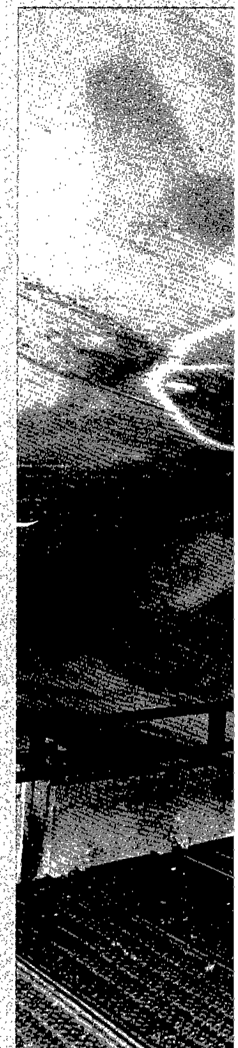
Of these mine-building nations, approximately 20 are in the habit of selling their wares to others. As a result, about 50 countries — not all of whom are friendly to the United States — maintain significant sea mine inventories. Mines are popular because they are a cheap and effective way of slowing the tempo of naval operations, especially for an adversary up against multimillion dollar sensors and weapons platforms.

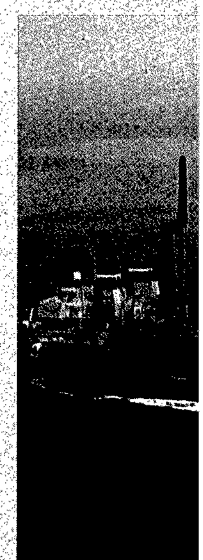
Mined waters limit the mobility of aircraft carriers, surface combatants and amphibious ships that would otherwise seek tactical advantage in bold maneuver. Indeed, in many situations, ships faced with naval mines can do little more than wait for dedicated mine countermeasures forces to arrive on the scene and sweep the waters.

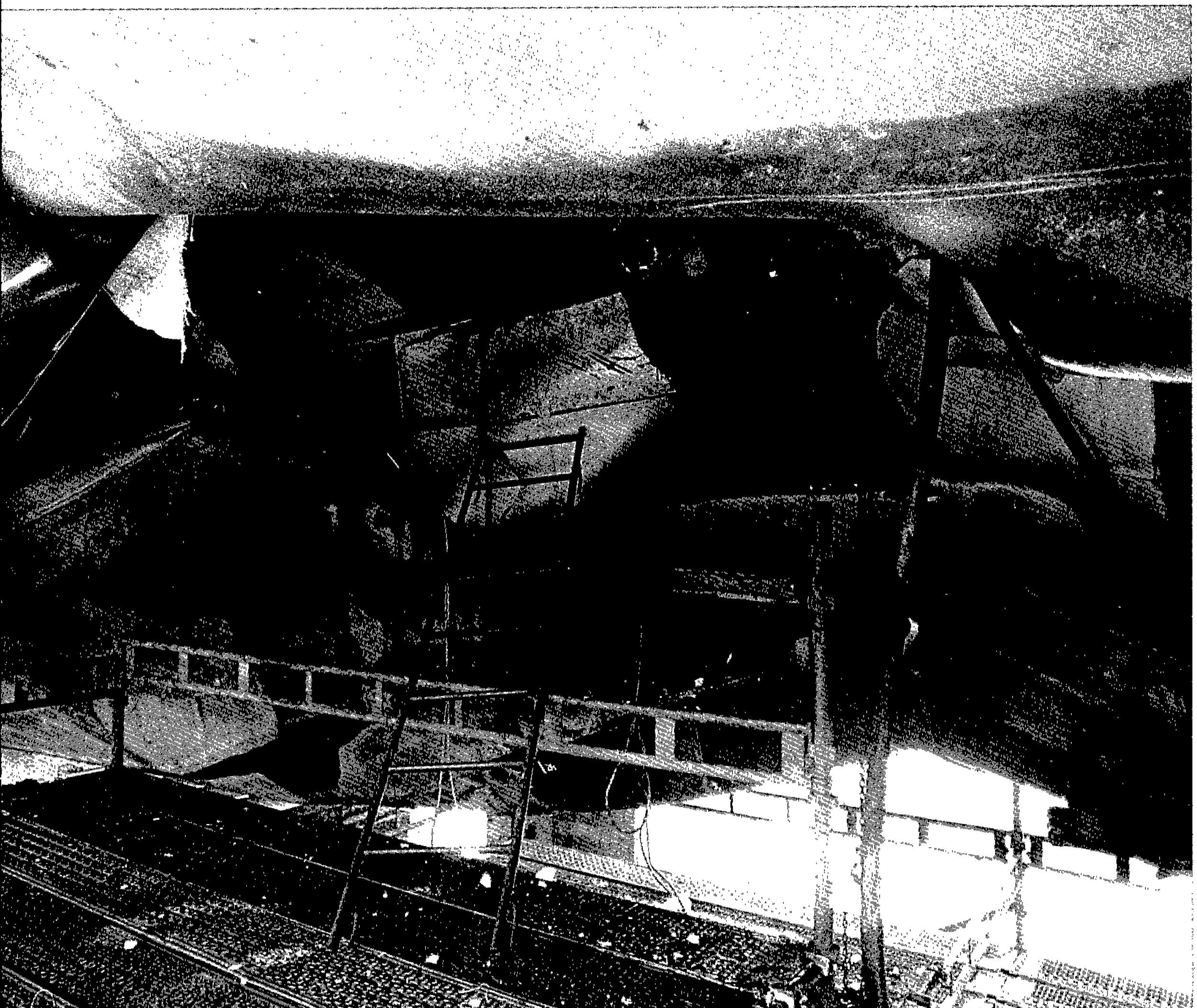
The price of all this waiting is often a high one. Opportunities to exploit enemy mistakes or follow up friendly successes are lost; dangers from enemy antiship missiles, fast patrol boats and diesel submarines are increased.

The Naval MINE THREAT to U.S. Surface Forces

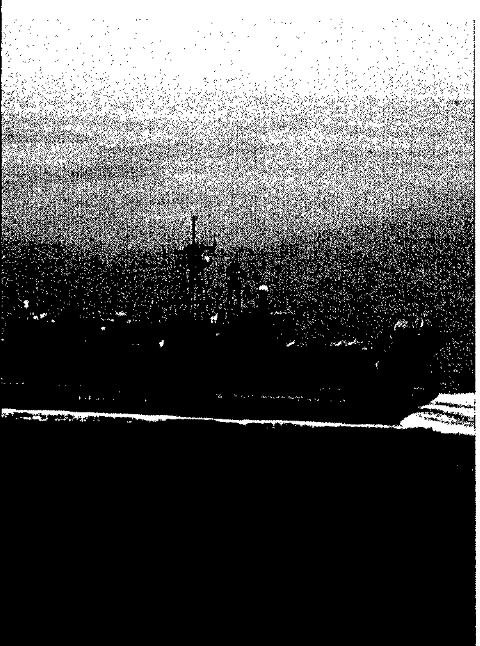






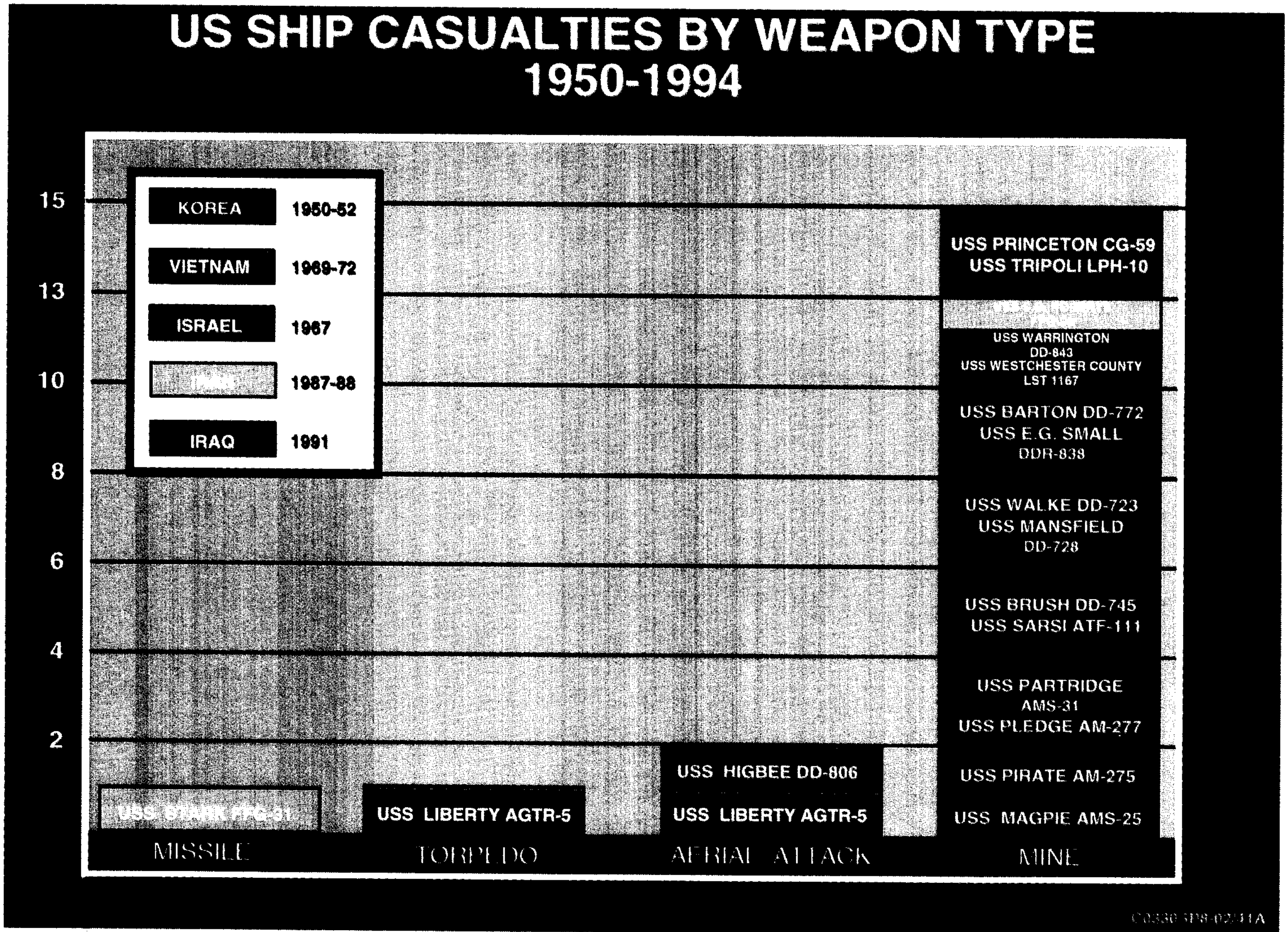


Far left: A simulated mine explosion *(Todd Chiconowics/USN)* *Left*: The damaged hull of USS ***Samuel B. Roberts*** (FFG 58) *(Rudy Pahoyo/USN)* *Below*: ***Roberts*** on board transport; en route stateside repairs. *(USN)*



by Jeanne Avery, ONI

Mine warfare has been part of naval history for more than 200 years, and has consistently influenced naval and joint operations — and repeatedly challenged U.S. maritime dominance. More than 70,000 mines were laid in a 200 nautical mile-long minefield during the 1918 North Sea Mine Barrage, and more than 700,000 mines were laid during World War II, accounting for more ships damaged or lost than any other weapon in war. Low-technology (low-tech) mines caused hundreds of millions of dollars in damage to U.S. combatants during the Tanker and Gulf Wars and cost multinational forces tens of millions of dollars to counter them. Similar mines have twice complicated U.S. amphibious force landings — first at Wonsan, Korea, in 1950, and more than 40 years later in Kuwait.



(ONI and NSWC Dahlgren Division, Coastal Systems Station, PanamaCity, Fla.)

The historical success of simple contact and influence mines suggests these weapons will continue to challenge U.S. naval forces. However, today's Navy can expect to encounter the gamut of naval mine types and must be prepared to counter traditional low-tech mines as well as technologically advanced systems. Level of technology notwithstanding, naval surface forces in the 21st century will require more than a casual awareness of mine warfare.

Since 1986, the number of naval mines and "mining-capable" countries has rapidly increased. Today, more than 50 countries — including those in all current regional "hotspots" — have some degree of mining capability. Several of these, including Iran, North Korea, China and Russia, have thousands to tens of thousands of mines complemented by a fleet of minelaying-capable platforms.

The increasing number of mining-capable countries is due in part to the increasing number of mine producers and exporters, among them, Croatia, India, Sweden, China and Russia. Historically, widespread availability and elementary technology contributed to the ease with which mines were acquired, copied, marketed and proliferated. Although low-tech mines continue to be manufactured and proliferated, mine producers and exporters are focusing on the growing demand for more capable weapons. As these modern mines are proliferated, so too is their advanced technology. However, despite innovative technologies that will improve worldwide mining capabilities, the challenge posed by World War I/II-vintage moored contact mines, like those used in the Tanker and Gulf Wars, will persist.

Traditional Mines

Nearly 90 percent of all mining-capable countries — including Iran, Iraq, North Korea, Pakistan, India, Cuba, Libya and Syria — have moored contact or moored influence mines. Moored mines can be anchored in waters as deep as 1,000 meters, although case depths are limited to 100 meters or less to sufficiently damage surface ships. Environmental factors such as current and tide can alter the mine's orientation and depth and reduce its effectiveness. For example, low tide can cause a moored mine to float to the surface, thereby revealing its location.

Bottom mines are less susceptible to environmental influences and are in the inventory of all but a few mining-capable countries. Although advertised for use in waters as deep as 300 meters, even bottom mines with large 1,350-kg TNT-equivalent warheads, like the Russian MDM-5, are less effective against surface targets as planting depths increase beyond 100 meters.

Water depth and environmental influences limit the utility of bottom and moored mines. Drifting mines may be better suited for these conditions because they typically operate in the volume down to eight meters below the water surface. International law limits their operational life to one hour although adherence is difficult to enforce. Additionally, moored mines with considerably longer lives can become drifting mines if their mooring cables break or are cut. Such was the case during Operation Desert Storm when Iraqi LUGM-145 contact mines were found adrift in the Arabian Gulf. Drifting mines remain an unpredictable challenge to today's surface forces.

Moored, bottom and drifting mines can threaten ships under way while limpet mines can be used to target surface ships in port. Iran, Libya, North Korea, India, the Federal Republic of Yugoslavia and Sri Lanka are among the

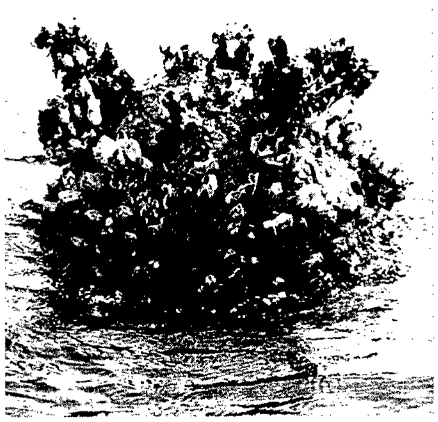
many countries known to maintain a limpet mine inventory. In June 1997, frogmen from a separatist insurgent group likely used a limpet mine to damage a Greek cargo ship anchored in a Sri Lankan harbor. This group is also suspected of using limpet mines to sink at least two Sri Lankan navy patrol boats in 1995. Despite the negligible level of attention given to limpet mines, these incidents are a reminder of their potential threat.

Emerging Technologies

Simple, moored contact mines dominate the stockpiles of at least 20 countries worldwide and many still incorporate dated, but generally reliable, technology and components. Obsolescent influence mines can be refurbished to extend their operational life. Upgrade kits are used to modernize the mine's firing mechanism while retaining its original case and warhead. Modern influence mines may incorporate several advanced technologies to improve their reliability and versatility. Stealthy designs, including the use of fiberglass case materials, increase resistance to countermeasures and reduce maintenance requirements. Remote control technology provides the tactical advantage of turning mines on or off, or detonating them. Improved sensors, propulsion systems and deployment methods can increase the mine's versatility, effective range and countermeasure resistance.

The countermeasure-resistant Swedish ROCKAN mine *(ONI)*

The Swedish ROCKAN bottom mine has a wedge-shaped, corrosion-resistant fiberglass case and is among the stealthiest designs on the export market. In addition to unconventional shapes, stealth features include anechoic coatings or nonferrous materials to reduce the mine's acoustic or magnetic signature, respectively. The stealth capability of a moored mine can be further improved by close-tethering the case to the anchor and by deploying it in deeper waters where mechanical minesweeping efforts are less effective.



Mines remain a hazard long after the conflict ends. *(ONI)*

The concept of remote control (RECO) was introduced by the Confederacy during the American Civil War. Although the basic technology is dated, the use of RECO over the last decade has dramatically increased. Many of today's mines, including Russia's widely exported, UDM bottom-influence mine, either come equipped or can be backfitted with RECO-capability. At least 10 countries have RECO-capable mines, and several may be exporting the technology. The tactical advantages of RECO systems, especially in defensive shallow-water environments, likely will further their development and use.

Naval mines with improved influence sensors are augmenting low-tech mine inventories, gradually replacing these older systems. Influence mines are detonated by ship-produced signatures such as magnetic, acoustic (passive/active), seismic, pressure or some combination thereof. Single-influence bottom mines are the most common mine type, however, the trend is toward multiple influences (including pressure sensors) to improve targeting and countermeasure resistance. Pressure mines, under development by an increasing number of countries, are virtually unsweepable and must be minehunted. Although they are advertised for export, they have not yet been widely proliferated.

The greatest technological mine challenge for surface forces is from propelled-warhead (PW) mines. PW mines use buoyancy or a propulsion system to transport the warhead to the target providing greater range capability than conventional explode-in-place (EIP) mines. The faster the warhead reaches the target, the less time the platform has to initiate countermeasures or evasive maneuvers.

Propelled-warhead mines can be straight-rising, vectored or homing. Buoyancy-propelled mines are most effective in shallow waters against slow-moving targets, whereas rocket-propelled mines travel three times faster and can be used in waters as deep as 200 meters. China, for example, is marketing the EM52, which is a straight-rising, rocket-propelled mine for use against surface ships and submarines. Vectored mines with rocket-propelled warheads have even greater ranges than straight-rising mines, traveling at speeds of 60-80 meters per second or more. The most advanced PW mines have encapsulating homing torpedoes with remote control capability.

Russia is the technological leader in the field of PW mines, maintaining the largest and most diverse stockpile and, along with China, actively markets these designs internationally. These mines have yet to be widely proliferated; however, they would be particularly useful in areas like the Strait of Hormuz where excessive surface currents limit moored mine use and deeper waters limit the utility of bottom mines against surface ships. A few judiciously placed PW mines can reduce the need for a large number of EIP mines. Advancements in PW mine technology will result in improved target detection, increased lethality range and better resistance to countermeasures.

Deployment

Practically any surface platform, including fishing boats, patrol craft and merchant vessels, can be easily modified to carry mines. Merchant ships and other civilian craft make ideal minelayers because they are indistinguishable from non-minelayers in heavy traffic. All mines are deployable from surface vessels and, depending on their configuration, some mines also can be deployed from aircraft or submarines. The choice of a minelaying platform used by an adversary will depend on the nature of the mining operation, the assets available and the degree of desired covertness.

Submarines are ideally suited for covert minelaying and as these platforms become more common, so too will submarine-deployable mines. Mobile mines like the Russian SMDM combine a bottom influence mine with a torpedo afterbody to provide a considerable standoff capability, but require a one-for-one torpedo

tradeoff. The SMDM is marketed for export as an efficient, highly sweep resistant, antisurface/antisubmarine warfare weapon for use in constrained coastal waters that may be inaccessible to conventional minelaying platforms.

The number of mines carried on a submarine has traditionally been driven by the mission as well as the number of torpedoes willing to be sacrificed. To avoid sacrificing firepower or self-defense, a small number of countries are acquiring externally mounted mine delivery systems like belts that also increase the submarine's overall mine-carrying capability.

Psychological Threats

Countries lacking sufficient minelaying platforms, operational mines or the time necessary to lay them, may exaggerate the threat by making false mining claims. By announcing or feigning mine deployments, an adversary can create a psychological threat and stymie naval operations. The most efficient "minefields" contain few, if any, actual mines. Sun Tzu, Chinese military strategist and philosopher, stated: "To subdue the enemy without fighting is the acme of skill." Proclaimed minefields are the epitome of this philosophy.

Mining capable countries still stockpile significant numbers of moored contact mines. *(ONI)*

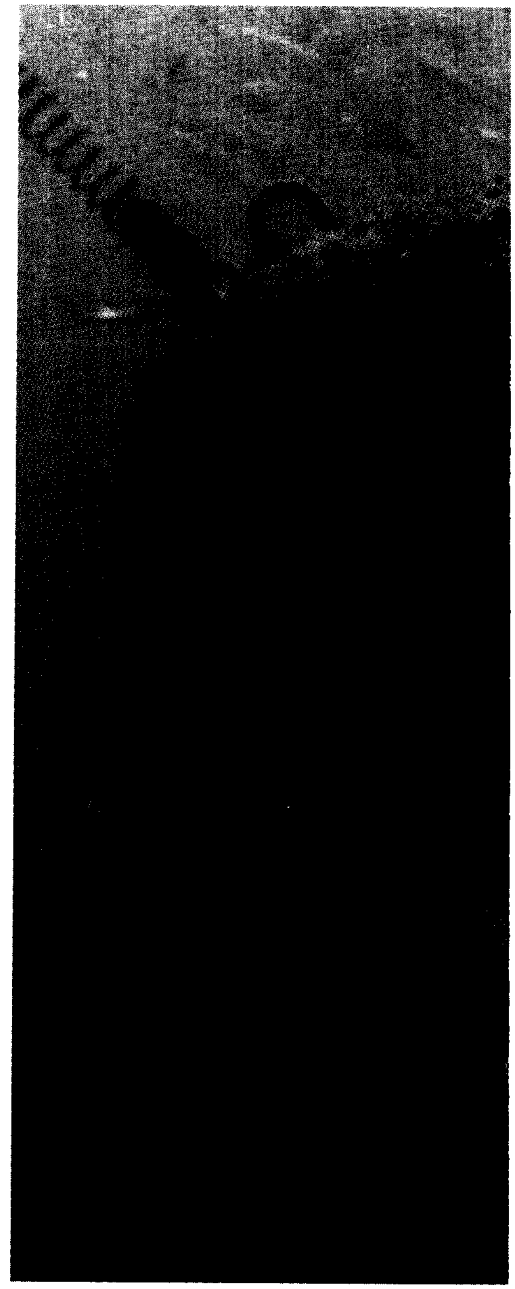
Dummy mines, which may be empty cases, mines without warheads or functional electronics, or simply mine-like objects (e.g., barrels or drums), can be used as a force multiplier. Dummy mines complicate and prolong mine countermeasure (MCM) efforts because they are immune to influence minesweeping and must be minehunted.

Proliferation

The mine's ability to function as a force multiplier (real or perceived), combined with its cost-effectiveness and ease of deployment, make it a highly sought-after naval weapon. As such, mines are in demand by a growing number of countries that lack the necessary resources to produce useful quantities of their own, such as Iran, Iraq and North Korea. An increased number of manufacturers and improvements in production efficiency are helping to lower the price of newer weapons, including propelled-warhead mines. The steadily increasing number of mine producers and exporters is enabling countries without an indigenous production capability to access everything from simple, moored contact mines to advanced, propelled-warhead mines.

Mine counter measures which include minehunting and mechanical or influence minesweeping techniques, are required to reduce the threat posed by deployed naval mines. A comprehensive understanding of the mine threat, and knowledge of its characteristics and capabilities, are necessary to determine the most appropriate countermeasure technique.

In addition to an overall increase in the number of mines to potentially be countered, advanced mine technologies are further complicating MCM. For example, close-tethered PW mines in deep water are countermeasure resistant and require deep mechanical and specialized influence sweeps or, alternatively, variable-



depth minehunting sonar and modified neutralization systems. Countering these mines is considerably more time consuming and expensive than countering shallow-water mines. In addition, minefields that contain a variety of mine types (including stealthy mines) may require different countermeasures. Naval mine capabilities still exceed the countermeasure capabilities available today, and mine designers continue to improve their designs to stay a step ahead of MCM capabilities.

Counter-MCM

In addition to advanced technologies that improve the mine's overall performance, some mines also are equipped with sophisticated features designed to increase their resistance to countermeasures and potentially reduce their vulnerability to environmental disturbances.

A diver attaches an inert charge to a mine. *(USN)*

Counter-countermeasures (CCM) help the mine eliminate false contacts. They have the capability to count targets, so that a certain number of ships are allowed to pass before the weapon is detonated, and switch off in periods of reduced activity. CCM features include arming delays, ship counters, dormant periods, remote control and stealth to extend the life of the minefield, damage the minesweeper or defeat MCM equipment, and force the use of time-consuming minehunting.

Great Potential

Throughout history, mines have posed a challenge for naval surface forces. Although large-scale maritime mining efforts ended with World War II, minefield effectiveness has not been compromised. At least 14 U.S. vessels, including three in the last decade, have since been damaged or sunk by mines during relatively small-scale mining operations. During the Gulf War, for example, Iraq exhibited a significant mining effort by laying approximately 1,300 mines — a relatively minor endeavor compared to historical efforts. Despite the fact that most of Iraq's mines were nonfunctional or ineffectively laid, three mines were successful in seriously damaging two U.S. warships.

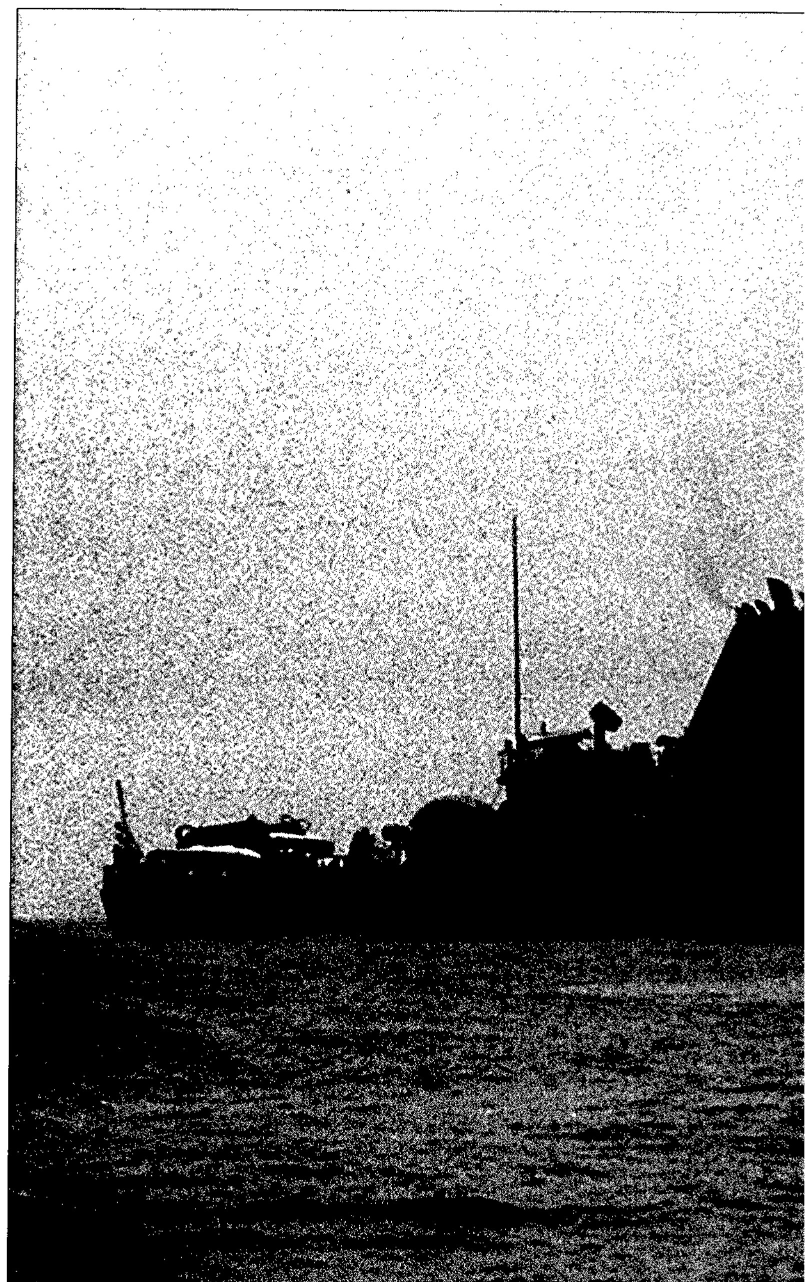
Mines present traditional as well as new challenges for surface forces in the 21st century. Low-tech mines will continue to dominate the stockpiles of most mining-capable countries. However, these low-tech mines are likely to be used in smaller minefields augmented by fewer, but more capable and reliable weapons, such as multiple-influence bottom mines and propelled-warhead mines. In support of an increased desire for modern mines, aggressive research and development efforts are in progress to further mine improvements. The historical success and widespread availability of mines will encourage countries to either increase their reliance on mines or obtain a mining capability. Advanced technologies and expanded warfare applications will further improve mining capabilities worldwide. As a result, mines have the potential to disrupt the operations of naval forces.

Editor's note: Jeanne Avery is a senior mine analyst for the Office of Naval Intelligence (ONI). She is on a long-term assignment from NUWC Newport, R.I.

Shaping the

Organic Mine Countermeasures

by Maj. Gen. Edward Hanlon Jr.,USMC



Battlespace

Because they cannot be everywhere at once, the Navy's mine countermeasures (MCM) forces face unique challenges. Indeed, by their very nature, dedicated MCM forces — the ships, helicopters and dive units with the exclusive mission of clearing naval mines — must operate in a concentrated manner. Spread too thinly, they lose much of their effectiveness. In particular, they lose the synergy — what Marines often call the "combined arms effect" — that comes from applying a variety of detection, classification, identification and neutralization techniques to a group of mines.

USS ***Ardent*** (MCM 12) practices mine countermeasure drills in the Persian Gulf. *(Jonathan P. Guzman/USN)*

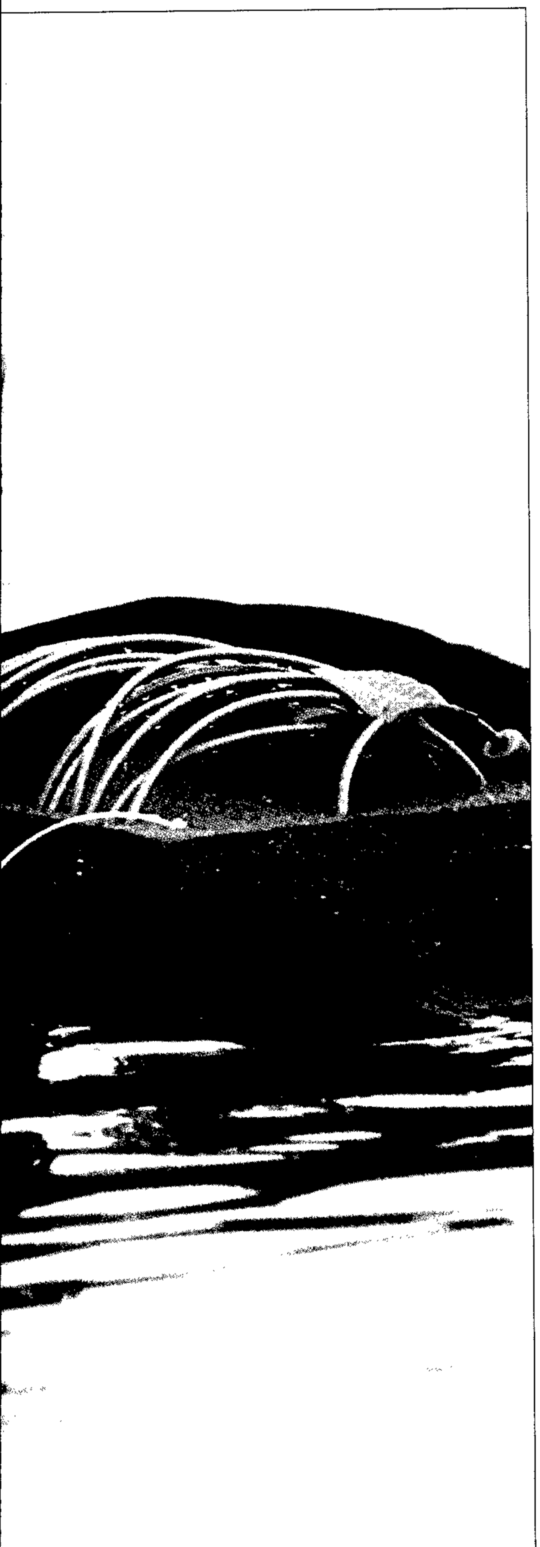
At the heart of the plan for organic MCM is recognizing that the problem of dealing with naval mines is a complicated one. *(Dwight Davis/USN)*

Since dedicated MCM forces will be otherwise occupied, the solution to the problem of scattered naval mines must be found elsewhere. Indeed, to preserve the freedom of movement of carrier battle groups, amphibious ready groups and other naval formations, ships must be given the capability to deal with mines without having to rely on outside help.

Moving forward in mine warfare to support the rapidly changing strategies and environments of conflict, the Navy/Marine Corps team is developing a capability to conduct MCM *organic* to the force. Organic MCM will allow the joint task force commander to seize the advantage and shape the battlespace, using multiplatform and multidimensional combat systems networks.

These systems provide a toolbox of sensors and weapons for the commander to use; putting the optimum integration of systems against the threat. The toolbox is a family of H-60 helicopter-equipped airborne MCM systems, surface-ship deployed mine reconnaissance capabilities and submarine-deployed mine reconnaissance systems.

Mine clearing operations and exercises are conducted in most of the world's regions, particularly in the Arabian Gulf, the North Atlantic, the Baltic Sea and the Mediterranean. These



exercises are helping the Navy and Marine Corps team develop plans to integrate organic MCM into nearly every naval operation.

Organic MCM Systems

At the heart of the plan for organic MCM is recognizing that the problem of dealing with naval mines is a complicated one. Mines on or near the surface pose different challenges than mines located on the ocean floor, and each must be treated differently. There is no single piece of equipment that can serve as an "all purpose" organic MCM device. Instead a family of MCM systems, each of which complements the strengths — and compensates for the weaknesses of the others — is needed.

The Navy/Marine Corps team is developing and fielding seven organic MCM systems: three underwater reconnaissance systems, two airborne mine detection systems, and two airborne mine destruction systems. Individually, each of these systems will deal with part of the operational challenges posed by small numbers of mines. Together, they form a potent response to the full array of naval mines, from traditional floating and tethered mines to sophisticated bottom mines.

The first systems to reach the fleet will be prototype underwater reconnaissance systems, the Remote Minehunting System (RMS). RMS is a diesel-powered, semisubmersible vehicle suitable for use from surface ships. The Near-term Mine Reconnaissance System (NMRS) is an unmanned underwater vehicle (UUV) designed to be carried, launched and recovered through the torpedo tubes of ***Los Angeles*** (SSN 688)-class submarines.

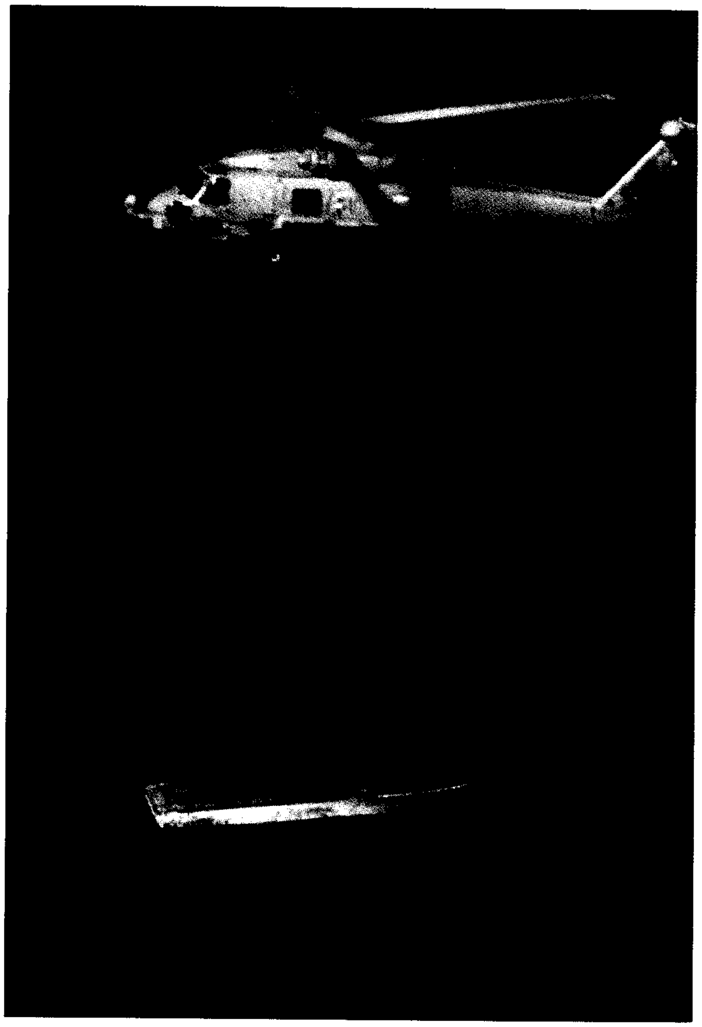
The RMS will be capable of locating and *neutralizing* mines. The two versions of the RMS currently under development are, however, purely reconnaissance devices using a combination of towed and forward-looking sonars to detect bottom and moored mines. The most sophisticated of these, the V(4) version, is being built with an over-the-horizon communications link that will give operational commanders the ability to remotely control the RMS to a range of approximately 100 nautical miles.

Like the RMS, the submarine-launched NMRS serves primarily as a reconnaissance device to locate mine-like objects and is being assembled from proven, off-the-shelf components. In contrast to the RMS, which uses wireless links, the

Mine clearing operations and exercises are conducted in most of the world's regions, particularly in the Arabian Gulf, the North Atlantic, the Baltic Sea and the Mediterranean. *(Stephen Batiz/USN)*

NMRS is connected to its "mother ship" via a fiber-optic cable.

The NMRS is an interim system that will be introduced to the fleet in the near future and used until relieved by the Long-term Mine Reconnaissance System (LMRS). The LMRS, which is currently in the prototype stage of development and scheduled for fleet introduction in FY 04, will be more capable than its predecessor. Endurance will be greater, sortie rates will be higher and the speed at which the system can search a given area will be faster. Additionally, the LMRS will be launched from the new attack submarines as well as those of the ***Los Angeles***-class.



Four systems are being designed for use in the H-60 helicopters, which serve as multipurpose platforms on many warships. *(Mike Larson/USN)*

To complement the three swimming systems, there are plans to develop four airborne MCM systems. These four systems — two sensors and two weapons — are being designed for use in the H-60 helicopters, which serve as multipurpose platforms on so many warships.

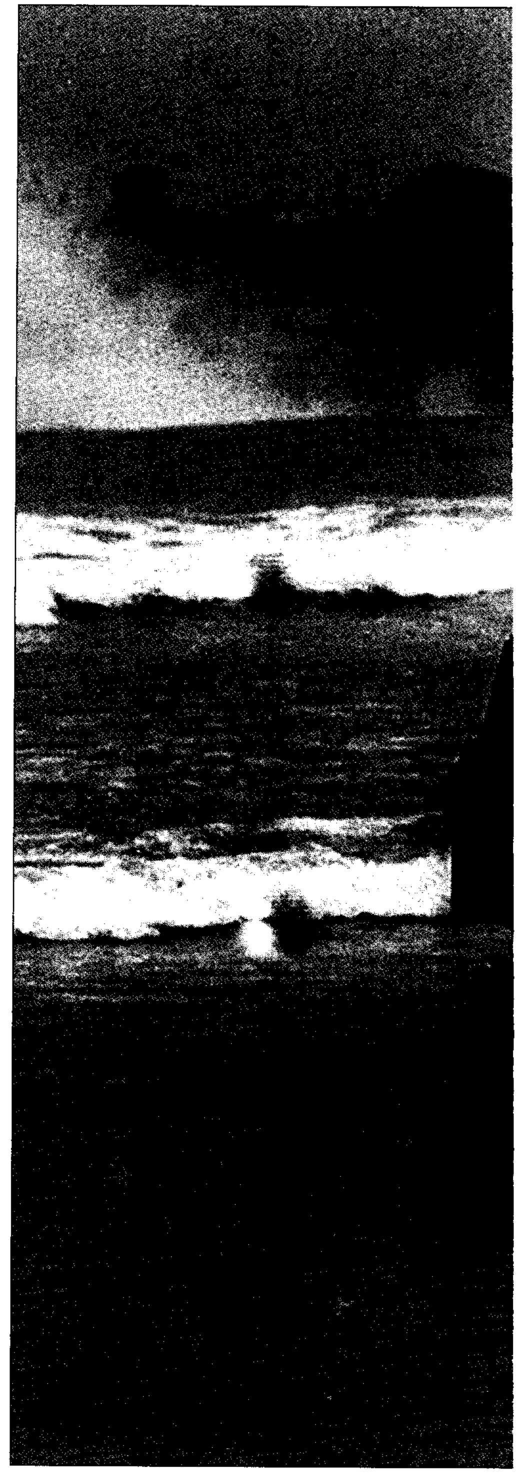
Thanks to the head-start provided by the Magic Lantern program, the first of these systems to benefit from those advancements will be an improved Airborne Laser Mine Detection System (ALMDS). Magic Lantern is a blue-green laser, shallow-mine detection capability. A Reserve SH-2G Seasprite squadron, HSL 94, currently maintains this contingency deployment capability. Like Magic Lantern, the improved ALMDS is a helicopter-borne device for locating floating mines and shallow-water tethered mines. To find other types of mines, particularly those in deeper water, bottom influence mines and rising warhead mines, forces will rely on the AN/AQS-20/X.

The defining characteristic of the AN/AQS-20/X will be a quantum leap in fidelity. Not only will it distinguish real mines from objects that merely look like mines, but it also will have an integral capability to identify specific types of mines. The AN/AQS-20/X will eliminate the need to send out divers or UUVs to investigate "mine-like objects," thus greatly decreasing the time it takes to identify and classify mines in the littorals.

Identification of a mine is only the first step in dealing with it. Each sensor will have a "running mate," capable of destroying the mines that it finds. The counterpart of ALMDS, the Rapid Airborne Mine Clearance System (RAMICS), is a 20 mm machine gun firing rounds capable of detonating mines in less than 50 feet of water. The Airborne Mine Neutralization System (AMNS), a warhead-equipped, remotely operated UUV designed to seek out and destroy mines located deep underwater, will be the partner of AN/AQS-20/X.

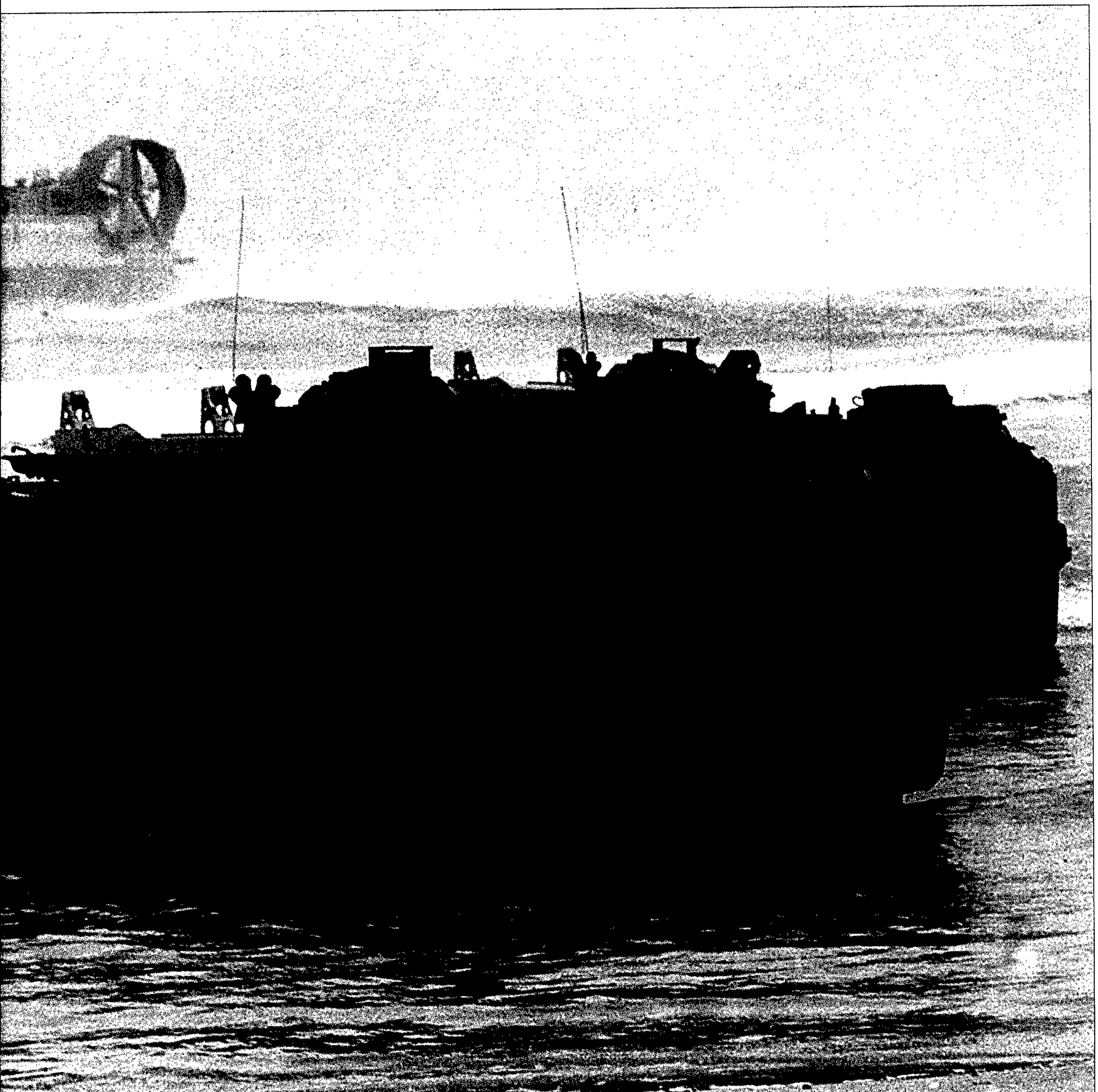
Mainstreaming

The seven systems being developed to provide organic MCM, address different aspects of the mine problem and are distributed among three different platforms. These seven systems, nonetheless, have much in common. They are mutually complementary, fitting together to form a whole that is much stronger than the sum of its parts. Most importantly, the systems will provide a new and powerful operational capability for carrier battle groups (CVBG), amphibious ready groups (ARG) and any other warship-based naval formations.



Moving forward in mine warfare to support the rapidly changi

The introduction of organic MCM systems to the fleet will have radical implications in the way that surface warriors conduct business. The notion that "mine warfare is somebody else's job" is obsolete. Overcoming the threat of naval mines is now an integral part of the surface warrior's core competency. Organic MCM —



strategies and environments of conflict, the Navy/Marine Corps team is developing a capability to conduct MCM organic to the force. *(Oscar Martinez/USMC)*

the use of reconnaissance systems to find, identify and employ specialized weapons to destroy hostile mines — will become as much a part of the repertoire of the surface warrior as antisubmarine warfare (ASW), antiair warfare (AAW) and antisurface warfare (ASuW) has over the years.

Developing an organic MCM capability within the CVBGs and ARGs is only part of the solution of a three-pronged approach that combines dedicated MCM forces with rapidly evolving capabilities in the areas of organic MCM and surf zone mine clearance. There will be some overlap between the skills and resources needed to succeed in each of these three areas. Nonetheless, it is important to note that these capabilities are mutually complementary rather than mutually competitive. To succeed in one or two is simply not enough. If we are to make the most of the great strategic potential of naval forces, we must master *all three*.

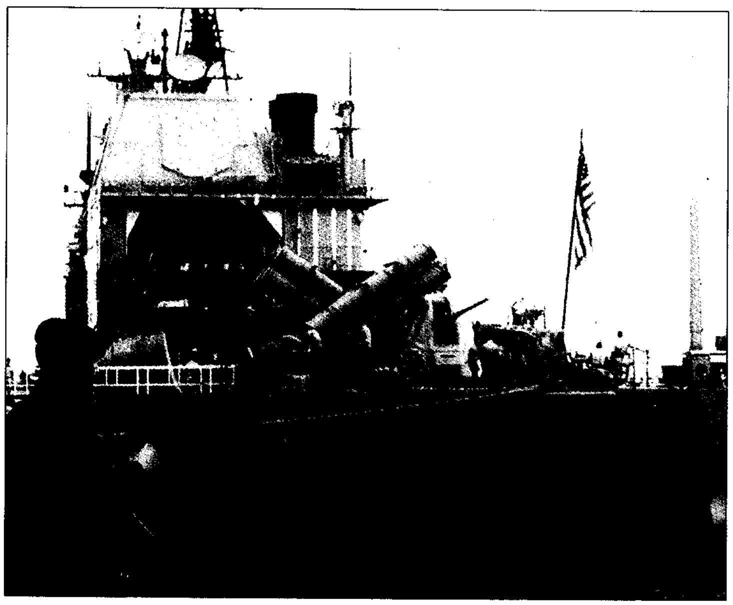
"Mainstreaming" mine warfare, however, is not an exercise of grappling with a paper tiger. Nor is it a fleeting thought process — something heard in briefings and filed away in the warrior's subconscious storeroom for future reference. It is deeper than that. Mine warfare is rapidly moving to the forefront of warfighting doctrine. It is an accompanying core competency for every surface warrior, aviator and submariner. As naval expeditionary forces become more organic in the next decade, it is incumbent upon all hands to *develop, exercise* and *apply* mine warfare skills to daily thought processes. The threat is real so think or sink.

Editor's note: Maj. Gen. Hanlon is Director, Expeditionary Warfare Division (OPNAV N85).

OFFENSIVE MINING

A True Force-Multiplier

Events in recent history — most notably the damage inflicted during Operation Desert Storm by enemy mines to USS ***Tripoli (LPH 10)*** and USS ***Princeton(CG 59)*** — were responsible for highlighting the need for enhanced mine countermeasures (MCM) capabilities. Since Desert Storm, the U.S. Navy's ability to conduct effective MCM has improved. However, there is another side to mine warfare — and that is offensive mining.



Mine-damage to ships such as USS ***Princeton*** (CG 59) during Desert Storm highlighted the need for enhanced mine countermeasures capabilities. *(USN)*

While recent history has emphasized the mine threat to naval forces, this emphasis has in many ways overshadowed the *value* of U.S. mine inventory. Mines are among the most versatile weapons in the Navy's arsenal, severely limiting an adversary's freedom of movement. Mines:

- protect naval forces in operating areas against surface and submarine attack,
- deny the enemy exit and entrance to his ports, and
- cause the enemy to abort his mission or force him into areas where his threat is minimized and/or U.S. forces are more effective.

Mines provide this capability through two principle means: direct destruction or disabling of enemy vessels, or limiting the movement of enemy forces due to the *threat* of destruction. It is that threat of damage —as opposed to the act of destruction— that can most effectively force compliance, significantly enabling the Navy to establish sea control and battlespace dominance.

by Dr. Ray Widmayer

Today's Mining Inventory

The concept of an unattended underwater explosive device (a mine) to be deployed against ships dates back to the late 1700s with "Bushnell's keg." This device was essentially a free-floating wooden keg filled with black powder and equipped with a primitive contact fuse using a flintlock trigger. Although only one rowboat was sunk, and that by accident, mine warfare was born.

Since the era of Bushnell's keg, mines have evolved from simple explode-in-place contact mines to sophisticated influence mines with encapsulated torpedoes. The current U.S. mine inventory includes the MK 56 moored influence mine, the Mk 60 encapsulated torpedo (CAPTOR) mine, the Submarine Launched Mobile Mine (SLMM), and the Quickstrike series of bottom mines.

The Mk 56 is a 2,000-pound, aircraft-laid, moored mine specifically designed to be effective against high-speed and deep-running submarines. The mine contains 360 pounds of high explosive and is equipped with a magnetic influence, mine-firing mechanism.

The Mk 60 CAPTOR is a sophisticated, aircraft-, submarine- and surface-laid, deep-water, moored mine with an encapsulated torpedo and an acoustic target detecting system. The mine — an antisubmarine weapon specifically designed to counter Cold-War adversaries—lies dormant until a valid target is detected. At detection, a modified Mk 46 torpedo is released to attack and destroy the target.

The Quickstrike Mk 62, Mk 63 and Mk 65

mines represent a new generation of cost-effective, quick response, aircraft-laid bottom mines. All three feature the same versatile multi-influence target detecting device (TDD) and are designed to be effective against both surface and submarine targets. The TDD senses the magnetic and seismic signatures of the target and contains complex algorithms that determine the optimal firing location while rejecting countermeasure signatures. The Mk 62 and Mk 63 are 500- and 1,000-pound mines, respectively, that use conversion kits to transform Mk 82 and 83 general purpose bombs into mines. The Mk 65 features a specially designed, thin-walled casing containing more than 1,300 pounds of underwater explosive.

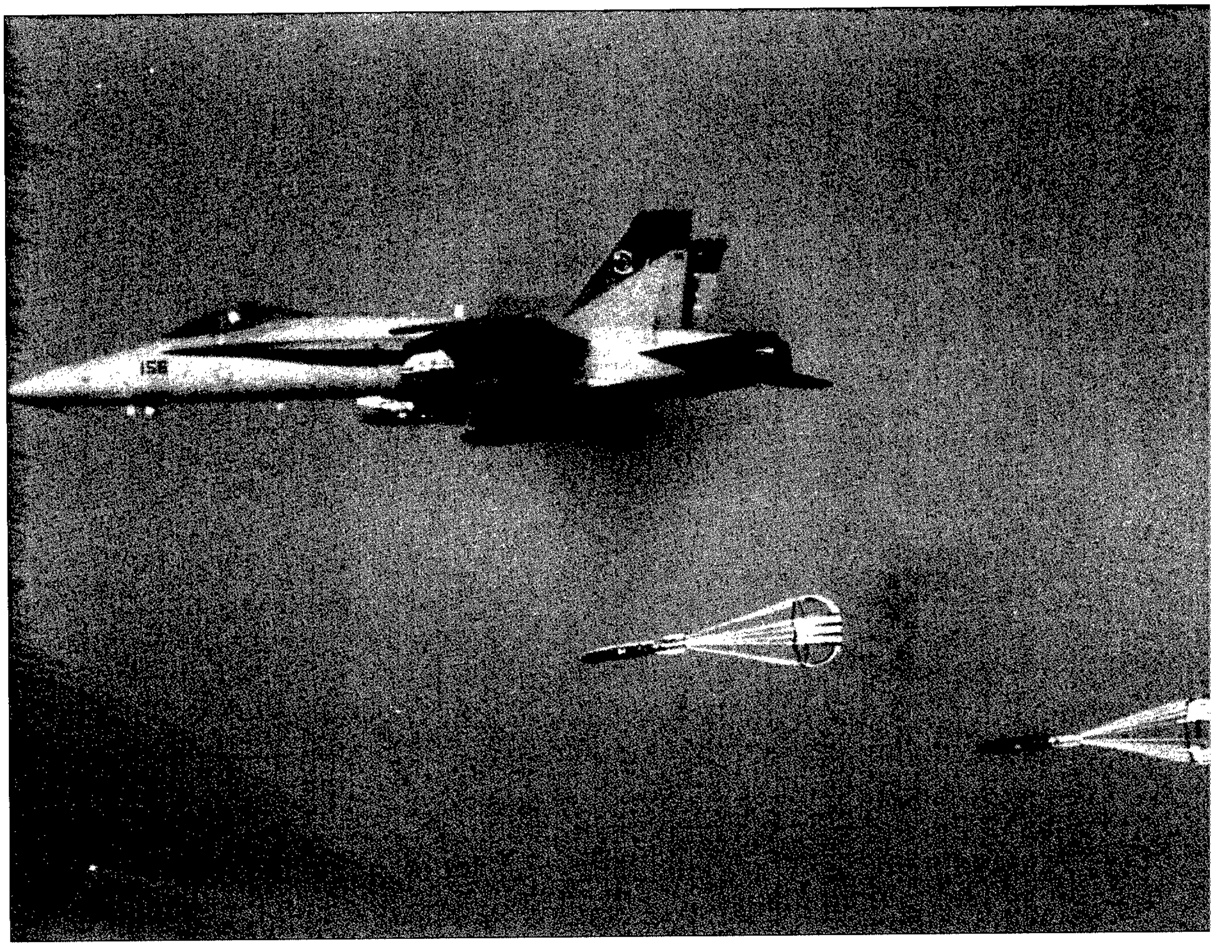
The Mk 67 SLMM is a bottom mine that uses a Mk 37 electric torpedo afterbody to provide the capability to be clandestinely launched from a submarine and be propelled to a predetermined planting location. The mine contains a 515-pound warhead and uses the same multi-influence TDD as the Quickstrike mines.

Strategic and Tactical Mine Use

It is the mine*field* that is the weapon, the mine*field* that is planned, the mine*field* that is laid, and the mine*field* that provides the force multiplication and sustained threat after a mine has been detected or actuated. With this concept in mind, mining operations may be divided into strategic and tactical categories. Strategic mining is preplanned as part of a broad naval offensive or defensive plan. Tactical mining plans are generated for targets of immediate opportunity to meet operational force objectives. Commander, Mine Warfare Command (COMINEWARCOM) plans both types of minefields to support the fleet Commanders in Chief (Fleet CINCs). COMINEWARCOM produces and distributes the strategic mining plans as minefield planning folders. These plans also can be developed as a rapid response. Each planning folder is associated with a different geographical area and consists of multiple minefield plans. COMINEWARCOM also provides technical advice to commands concerning mining plans and mine warfare readiness.

United States-laid minefields have both offensive and defensive purposes. Mining by the United States may include denying the enemy use of vital seas or protecting friendly harbors and channels. Minefields may be laid for the purpose of reducing the submarine or surface threat. Minefields also may be required for the protection of U.S. logistics routes, ports and operating areas.

Mining is a force multiplier, enabling multimission platforms to address mission areas other than undersea warfare (USW). Minefields also may be planned to disrupt the supply and logistics of an enemy port. On a broader scale, mining can disrupt the enemy's ability to conduct efficient and effective warfighting.



In the near future, the U.S. Navy will rely upon the Quickstrike family of mines to provide much of its mining needs. *(USN)*

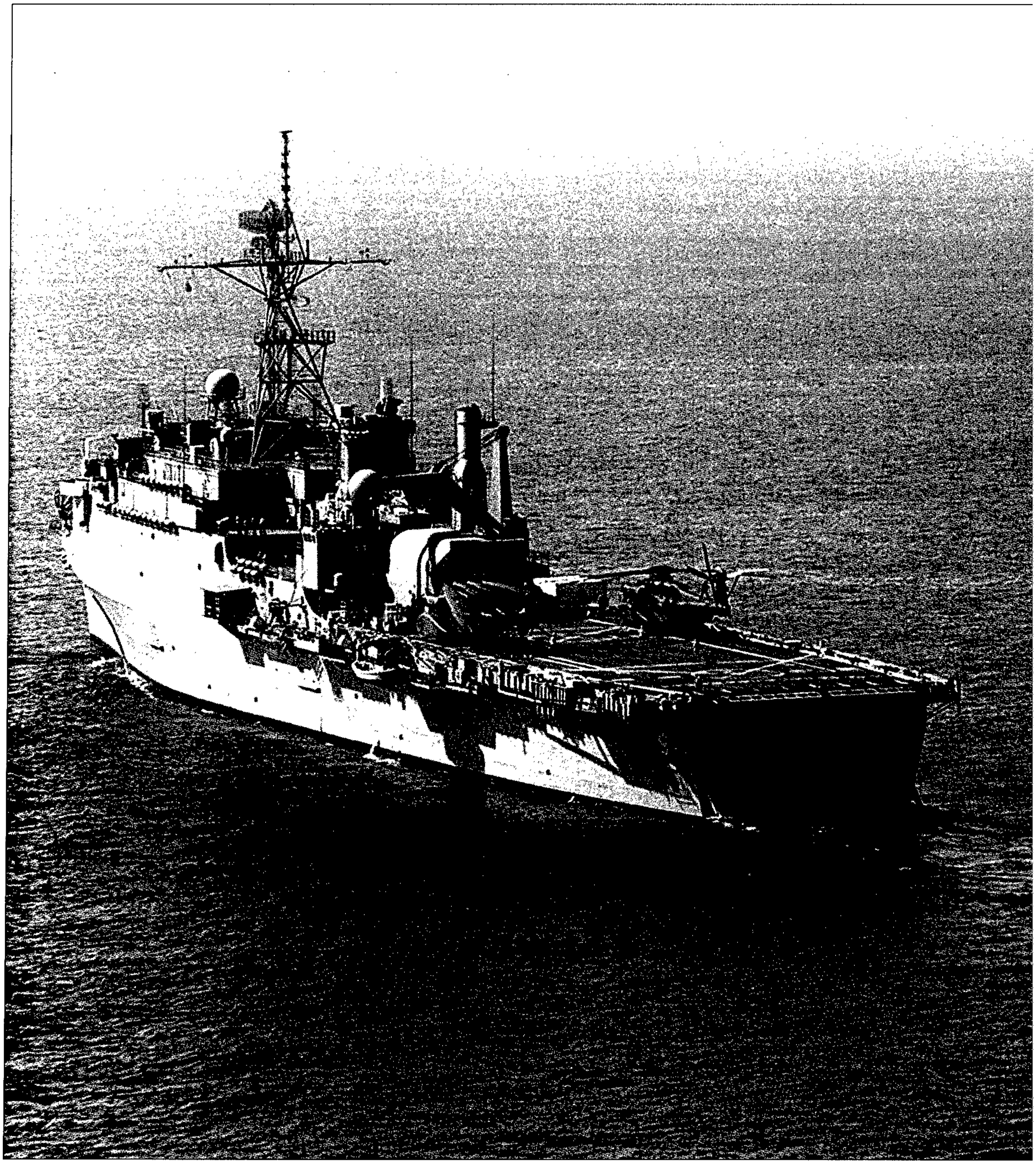
In concert with development of mining plans is the ability of the U.S. Navy to readily employ those plans. The Commander Mobile Mine Assembly Group (COMOMAG), with domestic and overseas detachments, ensures mine readiness through maintenance, assembly and preparation of mines for both exercise and mining campaigns.

Future Plans

Although highly versatile and effective in a variety of warfighting scenarios, the U.S. mine inventory was developed and acquired at a time when naval requirements were different than today. The issue in mining, as in any warfare arena, is adjustment to the post-Cold War era. The Navy's mining program must be aligned with the Third World, littoral warfighting requirements of the 21st century which are in stark contrast to the old blue-water, Soviet-driven threats.

Without question, some of the current mine inventory is obsolete in view of today's threats. The highly sophisticated, deep-water, Mk 60 CAPTOR mine is an example of this obsolescence. CAPTOR obsolescence, combined with its unusually high maintenance costs, have led to the decision to gradually eliminate CAPTOR from the mine inventory in the near term.

Equally obsolescent is the explode-in-place moored Mine Mk 56, although for different reasons than CAPTOR. As an aging, explode-in-place-only mine, the Mk 56 not only represents limited effectiveness, but also has environmentally unsuitable materials in its anchoring system. As with CAPTOR, the Mk 56 mine is being phased out of the inventory in the near term. Combined with the elimination of CAPTOR, elimination of the Mk 56 will leave the U.S. Navy *without* a moored mine capability. In particular, water depths beyond 150 feet no longer will be completely mineable, and water depths



Mines not only augment traditional USW forces, allowing a small force to do the job of a much larger force, but also free multimission platforms from USW responsibilities to pursue other missions. *(Jeff Viano/USN)*

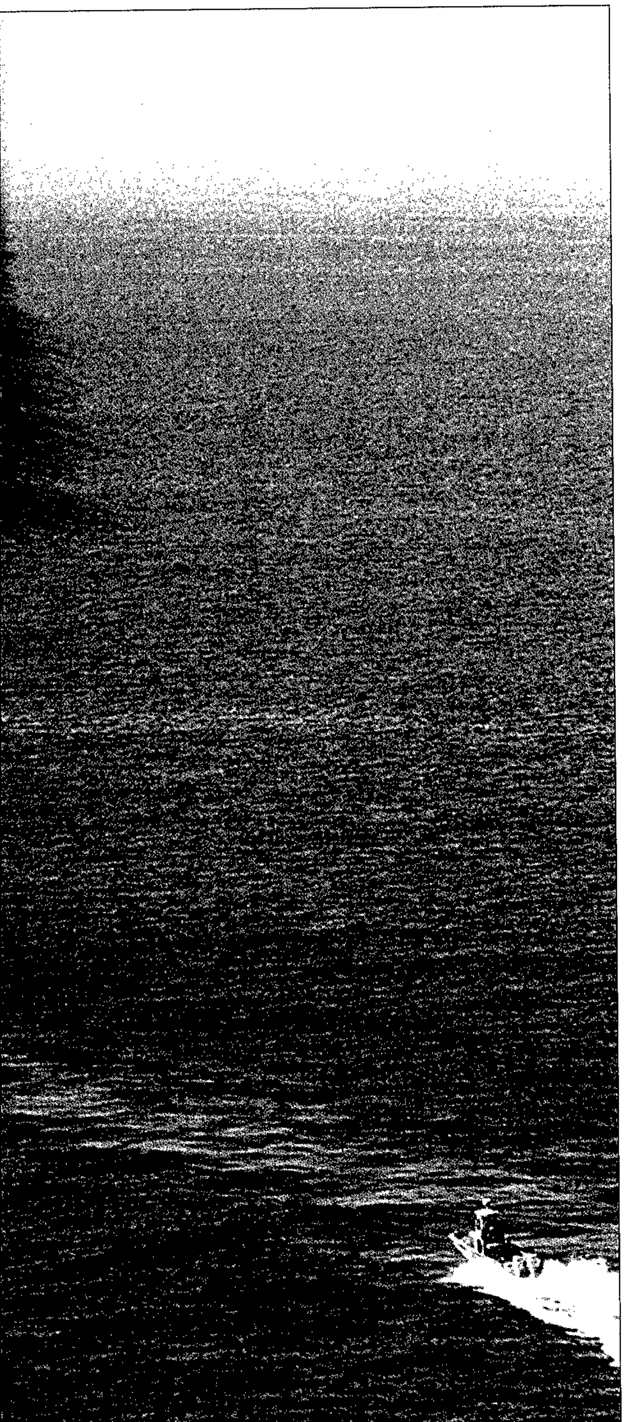
beyond 600 feet will not be mineable *at all.*

Finally, the Mk 67 Submarine Launched Mobile Mine will be phased out of inventory by the middle of the next decade. Cost of ownership and diminishing ability to provide adequate maintenance have combined to necessitate this decision.

Thus, in the future, the U.S. Navy will rely upon the Quickstrike family of mines to provide its mining needs. While the Quickstrike mines are exceptionally capable weapons, they simply can't meet *all* of the Navy's future mine requirements. Steps are currently being structured and implemented to begin a 21st-century plan of substantial capability improvement for mining, not unlike the concerted mine countermeasures improvement programs initiated by lessons learned from Desert Storm nearly a decade ago.

Several studies have been performed to consider the overall benefits of employing mines during a conflict. The studies concluded that mines are a force multiplier in an era of decreasing force levels generated by decreasing defense budgets. It was shown that mines not only augment traditional USW forces, allowing a small force to do the job of a much larger force, but also free up multimission platforms from USW responsibilities to pursue other missions. The study also concluded that a viable naval mine R&D program is essential to maintaining a first rate MCM capability. In order to design advanced mine countermeasures systems, the MCM designer must have a thorough understanding of the mines being countered. An active national mining program is essential to maintaining the required understanding of threat mines.

Therefore, based upon the favorable conclusion of the mining studies and the current status of in-service mine systems, several strong future mining initiatives are in the wings for



development and fleet introduction.

Potential Options for the Future

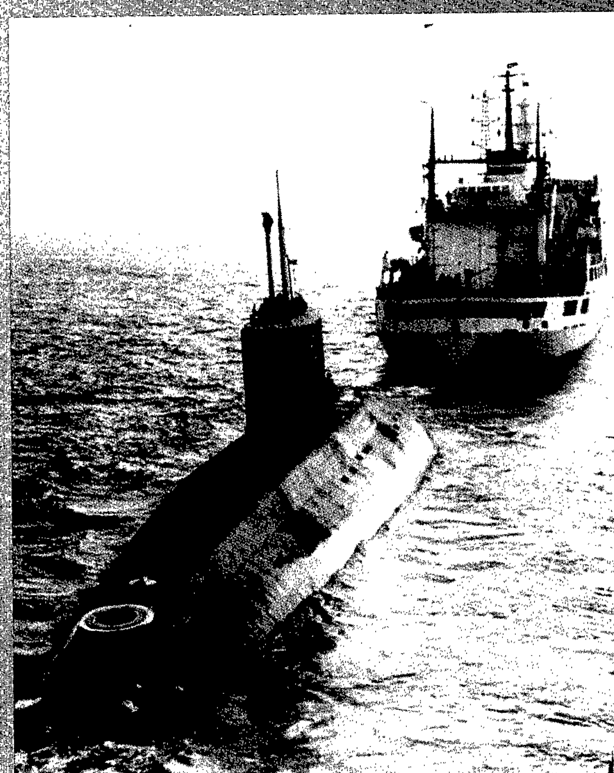
The **TDD Mk 71** is a fully developed, but not yet procured, programmable target-detecting device designed to work with the Quickstrike series of bottom mines. This new TDD can be reprogrammed to enable the Quickstrike mines to be effective against new and emerging threats as well as the typical threats in the littorals such as fast patrol boats and diesel electric submarines. Procurement of the TDD Mk 71 will extend the viability of the current bottom mines well into the 21st century. Proposed future development of the TDD Mk 71 includes adding a remote control (RECO) capability for highly reliable control of minefields.

The **Improved Submarine Launched Mobile Mine** (ISLMM) is a proposed replacement for the aging SLMMs being removed from service. The ISLMM consists of a Mk 48 afterbody and dual Mk 48 warheads. Improvements over SLMM include warhead delivery standoff range and additional maneuvering capability enlarging the delivery envelope. Also, the added warhead halves the number of weapon launches required to plant a particular minefield. Important to note is that the TDD Mk 71, as earlier described, will work equally well with ISLMM.

The **Littoral Sea Mine** (LSM) is envisioned as a wide-area coverage, intelligent, controllable, bottom-sitting mine for use in littoral waters. It consists of three subsystems: a mobile homing warhead, a multi-influence target detecting system (TDS) and a RECO system to facilitate stand-off control of the minefield. Its primary target will be the diesel-electric submarine transiting in midrange water depths, with a secondary capability against surface ships. An initiative is under way to team government and industry research facilities to demonstrate a preliminary, technology-level configuration of LSM within the next four years, with follow-on acquisition plans currently under evaluation.

In enemy hands, the sea mine likely will remain a primary threat to the navies of the world in the 21st century. It is just its remarkable effectiveness that leads to the undeniable conclusion that the sea mine should be fully utilized and developed as a force-multiplying weapon working for the U.S. Navy and its allies. Mines, the "weapons that wait," provide a strong, cost-effective component of the Navy arsenal.

Editor's note: Dr. Widmayer is the technical director for the Mine Warfare and Explosive Ordnance Disposal Branch (OPNAV N852).

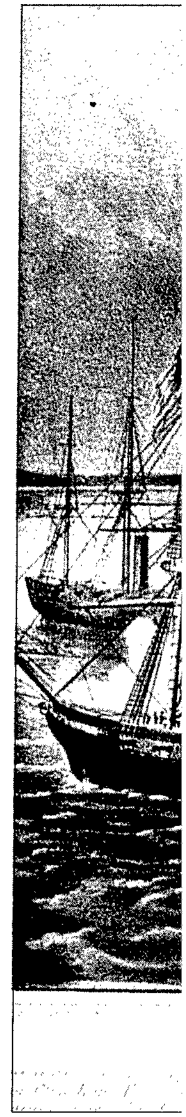


Iranian *Kilo*-class diesel submarine *(USN)*.

Programmable target detecting mines will give the U.S. Navy an effective weapon against new and emerging threats as well as the typical threats in the littorals such as fast patrol boats and diesel electric submarines.

The *History* of *Mining*

by Lt. Mark Zwolski



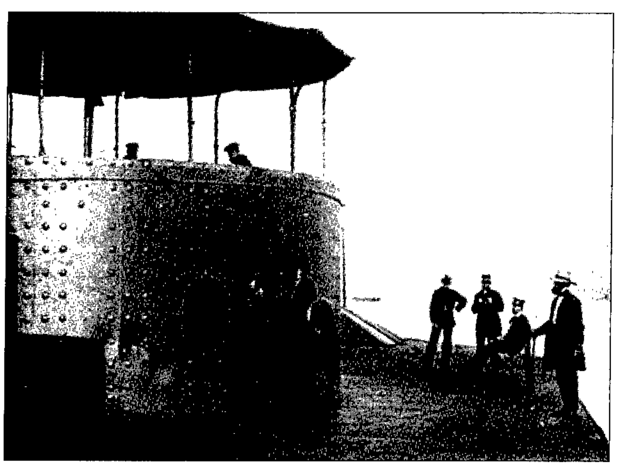
The first known naval mine was invented in 1776 by the American inventor David Bushnell.

Originally called a torpedo, the Bushnell mine was a watertight, wooden keg loaded with gunpowder and hung from a float. These mines were first used in 1777 when Gen. George Washington ordered a number of the kegs to be set adrift in an attempt to destroy a fleet of British warships anchored in the Delaware River outside of Philadelphia. This attempt failed, but the naval mine since has gained the reputation as the least expensive, yet most effective, offensive and defensive weapon of war.

Steamboat inventor, Robert Fulton, designed several naval mines between 1797 and 1812. The mines were tested successfully and offered to France, Great Britain and the United States, but they received little support. Naval mines also were used with little or no consequence in several European and Asian wars.

It was not until the U.S. Civil War that mines were used on a relatively large scale. At that time, the Confederate Navy, inferior in numbers to the Federal Navy, needed a weapon to compensate for their disadvantage. The naval mine (still called the torpedo) was adopted by the Confederates and used effectively to sink 27 Federal vessels, while only nine were sunk by artillery fire.

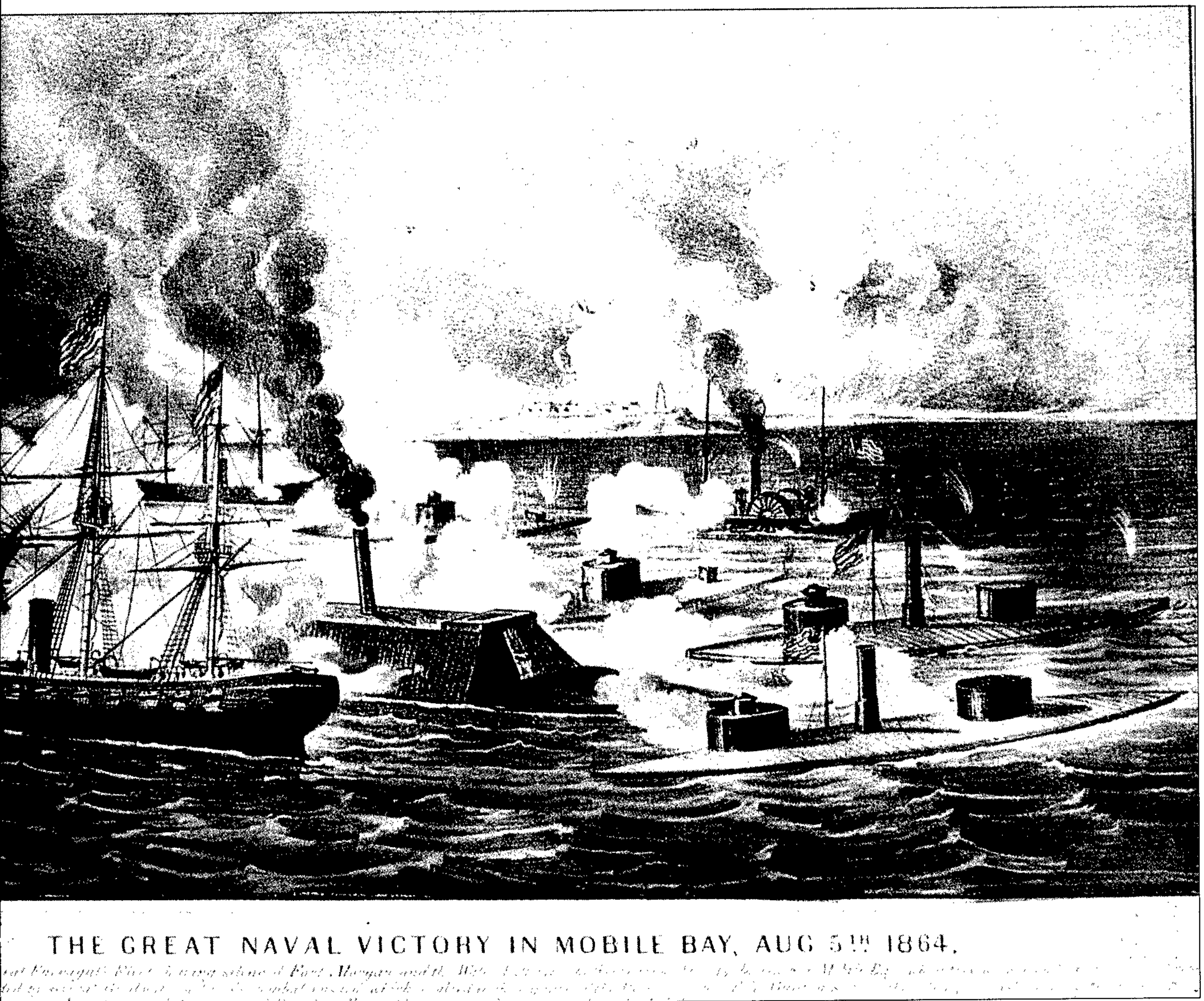
The naval mine emerged as the Allies' primary and most effective weapon against the German submarine during World War I. Over a five-month period, American and British minelayers planted more than 72,000 mines in a line extending 250 miles from Scotland to Norway. This gigantic mine barrage sank six submarines, damaged many more and forced U-boat commanders to either face destruction or waste precious time and fuel evading the barrage. There is no telling how effective this barrage would have been if it had been completed earlier, rather than at the end of the war.



It was not until the U.S. Civil War that mines were used on a relatively large scale. The Confederate Navy needed a weapon to compensate for their naval disadvantage. Shown, the deck and turret of USS ***Monitor***. *(Library of Congress)*

In the years of peace that followed World War I, the naval mine was all but forgotten. However, mine development was revived with the start of World War II. The airplane and submarine were introduced as minelayers and a new series of mines, influence type, were designed. These mines employed electronic detectors which responded to or were influenced by (thus their name) magnetic, acoustic and pressure changes resulting from a ship entering the mine's sensor range.

The extensive use of mines armed with new electronic detection systems, ship counters and arming-delay devices placed an immense burden on the mine countermeasures forces of both the Allied and Axis powers. During World War II, mines sank 1,316 Axis ships and damaged 540 while the Allies lost 1,118 vessels. The Axis and Allied nations laid more than 550,000 submerged mines during the war.



Battle of Mobile Bay *(courtesy of the Beverley R. Robinson Collection, U.S. Naval Academy Museum)*

A classic example of the use of influence mines was a multiphased mining campaign called Operation Starvation, carried out by the United States against the Japanese during the final stages of the war in the Pacific. U.S. aircraft laid more than 12,000 mines in Japanese shipping routes and harbor approaches, sinking 650 Japanese ships and totally disrupting all maritime shipping. Japan was completely unprepared to cope with these influence mines which saturated her home waters; those ships not sunk by mines were either forced to stay in closed ports or divert to a few overcrowded ports where they were prey to attack by aircraft and submarine. The virtual collapse of Japan's seaborne transportation and heavy industry resulted.

During the Korean Conflict, mining by Communist forces in Korea effectively hampered U.S. naval operations. During the landing at Wonsan in 1950, troop and support ships were prevented from entering port for more than a week. Most of the 3,000 mines laid were simple contact mines, yet they effectively hindered the mighty U.S. Navy. This embarrassment forced the U.S. Navy to review and reconstruct its entire mine countermeasures force.

During the Vietnam War, a new family of mines called *Destructors*, a bomb-type mine, came into use. These mines contained highly sophisticated, solid-state circuitry firing mechanisms inserted into the fuse cavities of general purpose bombs. The firing mechanisms were either magnetic or seismic.

The breakup of the Soviet Union, with its enormous stockpile estimated at nearly half a million sea mines, has resulted in the potential widespread availability of mines. A $1,500 World War I-vintage moored contact mine caused $96 million worth of damage to the USS ***Samuel B. Roberts*** (FFG 58) in the Persian Gulf. In fact, 75 percent of the damage to U.S. Navy capital ships in the last 10 years came from mines, two of which were World War I technology. Since the Persian Gulf war, the number of mine producers and mine exporters has grown significantly. Today, there are 49 countries that possess mining capabilities, 30 known sea mine manufacturing countries and 20 known exporters.

Naval mines have come a long way since the Bushnell torpedo of 1777. The naval mines employed today are more sophisticated and of global strategic importance. They are relatively simple technologically, with most nations possessing the knowledge to produce advanced designs. Naval warfare has many sophisticated weapons ranging from aircraft carriers to nuclear submarines. Yet, none of these weapons can be made as cheaply, produced in such massive quantities, planted in near secrecy, programmed to destroy with such lethal accuracy and be left completely unattended. Naval mines may not get the press coverage that carriers, missiles and submarines receive, but they remain the most inexpensive and prolific weapon for control of the seas. Countries without a strong mine countermeasures force remain at the mercy of these potent and lethal weapons.

Enabling *Power Projection* in the *Littorals*

Mi

It's a familiar story.

Events unfolding half a world away threaten American interests. The call goes out and the U.S. Navy responds. As our Sailors and ships approach the foreign shore, unseen enemies — sea mines — lie just below the ocean's surface.

Countering those mines, and removing the threat they pose, is the mission of the U.S. Navy's mine countermeasures (MCM) specialists — the men, women, ships and aircraft of the Mine Warfare Command.

by Rear Adm. Dennis R. Conley

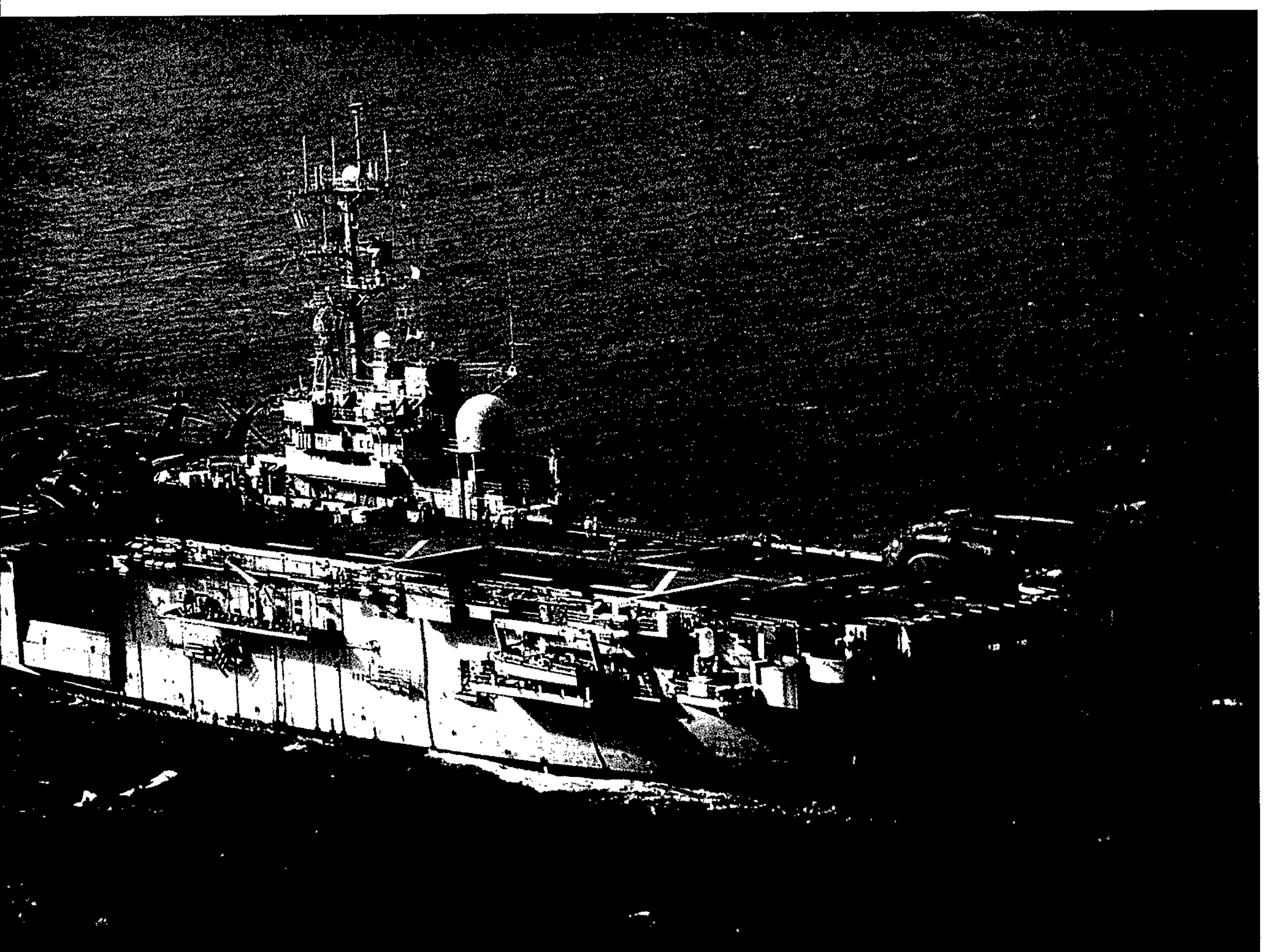
Fifteen years ago, the primary task of the U.S. Navy's MCM force was to clear our own harbors of mines, allowing the blue-water ships to head out to sea and take the battle to the enemy.

Since then, the world has undergone sweeping political and economic changes. The Navy has changed as well; our focus has shifted from blue-water operations to the littoral region. This "paradigm shift" brought the importance of mine countermeasures to the fleet back into focus. Today, the mine force is reborn, integrated, stronger than ever, and has a chain of command tailored to support the Navy's numbered fleets.

"In the past, mines were a cheap way to stop the
Now, it's the mines whose show is being

Rear Adm. Mike Mullen, Commander,

ne Warfare



USS ***Inchon*** (MCS 12) *(USN)*

ıow as far as littoral operations were concerned. ιopped. And that's a significant change."

SS *George Washington* Battle Group.

Maneuvering At Will

The mine warfare community has become an integral part of what our naval forces are working to accomplish as joint warfighters. *Joint Vision 2010* shows how important the ability to maneuver at will is to the fleet. To accomplish their assigned missions, ships and battle groups must be able to operate without fear of sea mines. The mine warfare community exists for that reason — to serve as the enabling force for the introduction of follow-on assets, clearing the mines that pose a threat to the rest of the fleet. The fleet's ability to maneuver at will is a direct reflection of the MCM forces' ability to counter the mine threat.

There is no better testament to the renewed importance and ability of the mine force than the faith placed in its Sailors and equipment by the rest of the Navy. Mine warfare, once overlooked as part of the Navy's mission, has gained new prominence from world events. The spotlight has shown a force that is well trained and ready to answer the call.

During the past year, a number of the initiatives undertaken in response to lessons learned from the Gulf War have come to fruition. In 1997, we witnessed the deployment of the first truly dedicated and integrated Mine Countermeasures Task Group in our Navy's history. USS ***Inchon*** (MCS 12) deployed to northern Europe with four surface MCM ships, HELMINERON 14 (HM 14) and Explosive Ordnance Disposal (EOD) Mobile Unit Six Detachment embarked for Exercise Blue Harrier '97.

This was followed by additional exercises with NATO allies in the Mediterranean. After returning and a brief visit to her Ingleside, Texas, homeport, ***Inchon*** with HELMINERON 15 (HM 15), four surface MCM ships and EOD forces participated in Joint Task Force Exercise (JTFEX) 97-3 with the USS ***George Washington*** (CVN 73) Battle Group and the USS ***Guam*** (LPH 9) Amphibious Ready Group. This exercise reflected significant strides in mainstreaming mine countermeasures into battle group operations.

"As a warfighter, I have felt for 20 years that a mine, or a mined area, is a showstopper for our ability to project power in the littoral," said Rear Adm. Mike Mullen, Commander, USS ***George Washington*** Battle Group. "With that in mind, I was really pleased to see such significant improvements in the mine force when I returned to sea as a commander."

This level of confidence in the mine warfare community is pleasing to note as our MCM forces hone their skills to execute their mission as expeditiously and completely as possible.

"Without MCM capability, we simply can't put Marines ashore, nor can we safely operate any ships in the mine-danger areas," Mullen said. "Because of that, full integration of mine warfare into the warfare campaign plan and the force commander's scheme in terms of sequence is vital. Without mine warfare, the campaign stops ... Seven or eight years ago, we didn't have the capable force we have today. Now we have a modern, robust force that is capable of filling a vital role in fleet operations. In the past, mines were a cheap way to stop the show as far as littoral operations were concerned. Now, it's the mines whose show is being stopped. And that's a significant change."

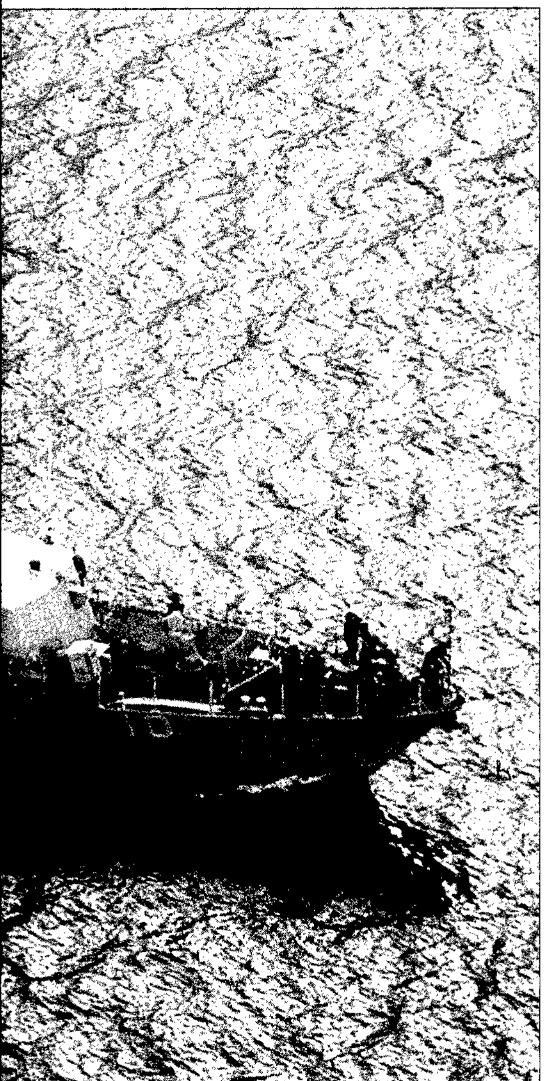
A major factor in the success of MCM efforts is the ability to be on scene when required to meet the mine threat. This requirement places MCM forces in the same role as other naval forces — to be relevant and to influence, we must be there. Having MCM capability forward-deployed, or able to respond and arrive expeditiously, is a challenge the force trains to meet. Today, USS ***Guardian*** (MCM 5) and USS ***Patriot*** (MCM 7) are homeported in Sasebo, Japan, maintaining vigil in the Seventh Fleet area of responsibility. Meanwhile, USS ***Ardent*** (MCM 12) and USS ***Dextrous*** (MCM 13) are on watch in the Persian Gulf, manned by MCM Rotational Crews from Ingleside.

To accomplish their assigned missions, ships and battle groups must be able to operate without fear of sea mines. The fleet's ability to to counter the mine threat. USS ***Firebolt*** (PC 10) *(Robert Sitar/USN)*

Meeting the Mine Threat

Another challenge for the force is accomplishing the many and varied tasks we may be assigned and to tailor our forces to meet whatever mine threat is imposed on us. For instance,

we may only have to be capable of transiting a narrow sea line of communication or, conversely, our mission may require us to clear a wide area for a battle group. As part of our mission, we also must be capable of clearing harbors and harbor entrances in order to introduce

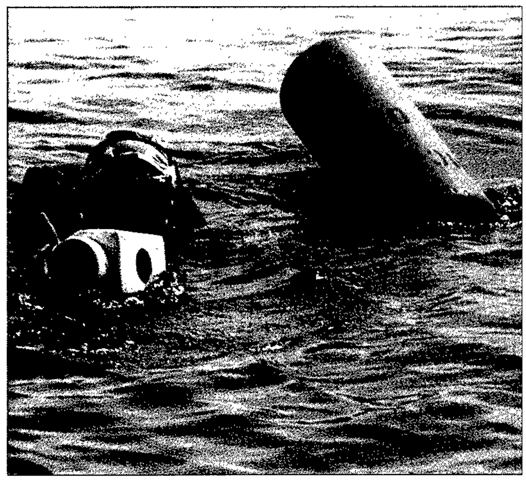


maneuver at will is a reflection of the MCM forces' ability

warfighting material into the theater.

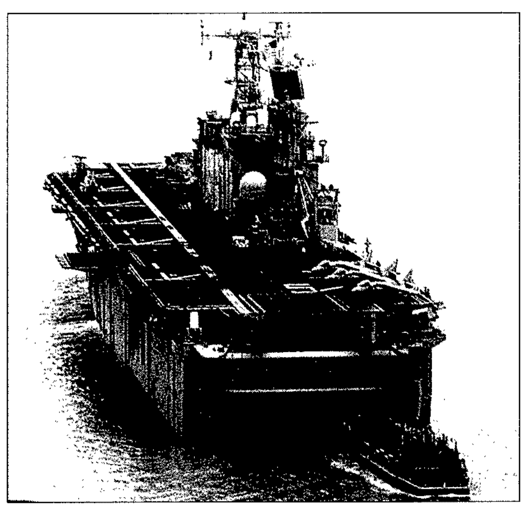
Once on station, we must be capable of meeting the timelines that are so critical to joint operations. We must be capable of getting into an area, and doing whatever is necessary to enable the operations of the naval forces. Whether it be as a precursor to amphibious operations, or to make an area safe for battle group operations, the mine warfare force must be ready and capable to answer the call for countermeasures.

The way the mine force performs these assigned missions has changed in recent years. Collocating our forces in South Texas has allowed us to integrate training and build the synergy that is so essential to the expeditious conduct of mine countermeasures operations. Another factor has been the maturing of our force into the most capable MCM force the U. S. Navy has ever known. We now have our first mine countermeasures command and support ship, ***Inchon*** and what soon will be 25 surface MCM ships. Additionally, we have EOD forces located in Ingleside and around the world, as well as two helicopter squadrons. These forces give us the ability to combine the speed provided by the airborne mine countermeasures (AMCM) helicopters with the capability of surface ships with embarked EOD personnel to go in, quickly identify and neutralize mines. The speed and synchronization experienced from operating today's forces in an "MCM triad" has been our foremost achievement.



A diver prepares to evaluate a mine contact detected by USS ***Ardent*** (MCM 12). *(Jonathan P. Guzman/USN)*

The addition of ***Inchon*** to the mine warfare fleet has increased our ability to operate independently, *Forward ...From the Sea*. ***Inchon*** brings a variety of capabilities that the force previously lacked. Standard practice for exercises before ***Inchon***'s arrival was to assign a ship from outside the mine force to serve as the command ship. This was necessary because of the small size and limited command, control, communications, computers and intelligence (C4I) capabilities of both ***Avenger***- and ***Osprey***-class ships. ***Inchon***, with its improved communications equipment, now serves as the flagship of the MCM force, capable of coordinating efforts not only for units of the MCM force but also with the battle group and joint task force.



Whether it be as a precursor to amphibious operations, or to make an area safe for battle group operations, the mine warfare force must be ready and capable to answer the call for countermeasures. *(USN)*

Inchon also is capable of supporting the ships that actually perform MCM operations. Refueling, reprovisioning and, to a limited degree, repairing of the mine countermeasures ships and minehunters can now be accomplished at sea. Add to this ***Inchon***'s ability to carry and support AMCM capability squadrons and EOD forces, and you have a highly capable platform that allows the mine force to operate anywhere around the world.

In addition, ***Inchon*** improves training of the MCM triad. By training like we fight, the force now can be better prepared for the times when exercises become operations, and possible contingencies become real-world events.

Another result of collocation has been improved maintenance capabilities. In Ingleside, we have facilities and repair personnel tailored to the needs of the surface mine countermeasures ships. The Sailors at these repair and maintenance commands are becoming more proficient at maintaining our systems. As their abilities improve, so does the readiness of our forces.

The changes in the world around us have also made it necessary to reshape and refocus the mine warfare community. We reorganized the command to include three mine countermeasures squadrons (MCMRONs) with approximately eight ships each, which enables better support and mentoring for our ships and people. These MCMRONs serve as the immediate superiors in command and exercise administrative and operational control of our ships, as well as operational control of the combined forces in the MCM triad.

There are many immediate benefits to be derived from the reorganization. The first is that we can provide ready forces, for deployment or major fleet exercises, just like we do for surface combatants or amphibious ships on a 'round the clock' basis. Also, the ships are now organized to undergo a deployment cycle like other classes of ships. This allows for predictability of schedules, improves maintenance planning and has

the added advantage of permitting our people to know what is in store for them in their personal lives as well.

We have one MCMRON that is focused on the 3rd and 5th Fleet, one that focuses on the Seventh Fleet and one MCMRON whose primary focus is the Second and Sixth Fleets. The latter is also a "swing MCMRON," should contingencies require us to have more than one staff or larger numbers of ships.

Full Integration

The new command structure of the mine force has brought mine warfare up to par with the other surface warfare branches. The commodores who command these three MCMRONs are full-time mine warfare experts. Working with their staffs, they establish contingency plans that allow them to operate anywhere in the world with any combination of forces. With their first-hand knowledge of the capabilities of the personnel and equipment of the mine force, the MCMRON commanders can give the commander at any level a credible appraisal of MCM options. In JTFEX 97-3, the mine problem was fully integrated into the execution of the joint task force commander's campaign plan and within the battle group, the MCM commander was tasked as an co-equal of other warfare commanders including the commander of the amphibious task force. Vice Adm. Vern Clark, Commander, 2nd Fleet and commander of the joint task force, acknowledged the role of the MCM forces when he commented, "One of the biggest impacts provided by MCM play in this exercise was to broaden and improve the battlefield and task force commanders' area of operational maneuver." He added that the capabilities of a mine warfare command and control platform, like USS ***Inchon***, provided force and group commanders a much better view of the battlefield. As the force ensured a clear and accurate view of the air campaign and surface picture, MCM platforms added valuable information to the total battlefield environment in attaining the best picture. "JTFEX 97-3 provided the opportunity for U.S. forces to focus together on a common objective under realistic and relevant conditions and to train with all the valuable assets, including MCM, to achieve force superiority," Clark said.

Vice Adm. Clark further stated, "Both on land and at sea, mines provide potential adversaries with a low cost means of obstructing our forces. Since JTFEX provides training that enhances the complimentary nature of the individual services while increasing the capabilities of the joint task force, using all assets available to the task force commander maximizes force capability. Especially in this day and age of smaller forces and decreasing defense dollars, we must extract the best capabilities of all those forces at our disposal. MCM is one of those assets."

To meet the new challenges of littoral warfare, we are working to improve every facet of the mine force. We are growing a cadre of professional enlisted personnel in the mineman rating, which takes former ratings that manned our ships, and changes the focus to provide the specialized skills required for mine countermeasures. We want a portion of our personnel to have repeated tours in Ingleside, and Sailors in the mineman rating will have a distinct advantage. This is a win-win situation for the Navy, the Mine Warfare Force and the Sailor involved.

On the officer side, our 1110 officers are coming for tours in the mine warfare force, experiencing mine countermeasures operations from inside the lifelines and then being detailed in accordance with other requirements for their broad professional development.We have billets for 28 lieutenant commanders to command our surface ships.

We also have a small cadre of 1140, special operations officers, who are being assigned to division officer, department head, executive officer and commanding officer billets aboard our ships. It is our intent for a small number of these officers to have repeated tours in MCM, and to be groomed for ultimate assignment as an MCMRON commander.

U.S. Navy MCM capability must continue to grow, improve and in the process, change. One of our future challenges is to have MCM capability forward-deployed with the rest of our naval forces. We are working very hard to achieve this goal, not only by embedding MCM expertise throughout the fleet but also by working to provide the fleet with organic MCM capability. What we're talking about is a capability that will be in the battle group and can be employed immediately to enable our battle group commanders to accomplish as much of the MCM mission as possible. This mission includes reconnaissance and ultimately, identification and neutralization, as the technology for organic capability improves. What we want to do is reduce, to the greatest degree possible, reliance on dedicated MCM forces, which may not be immediately available in theater.

Today's triad of MCM capabilities is pushing the tactical envelope in refining the integration of forces and contributing to doctrinal development of a mainstreamed mine warfare arm. Here, Sailors with EOD Mobile Unit 3 return to USS ***Denver***'s (LPD 9) well deck. *(Jeff Viano/USN)*

As we approach the 21st century, the mine force is poised to meet the challenges. New systems and technologies are being built and tested today that are going to add capability and response tools for unencumbered naval maneuver. Today's triad of MCM capabilities is pushing the tactical envelope in refining the integration of forces and contributing to doctrinal development of a mainstreamed mine warfare arm. But one message is loud and clear — building capability is a dynamic event and, to that end, today's mine force is a work in progress. The challenge of the mine threat is real and expanding; our ability to deal with it does not afford us the luxury of sitting back and thinking the job is done. As tremendous as the forward strides have been in the past few years, the mine warfare momentum must continue for our naval forces to fulfill their role in joint warfighting.

Editor's note: Rear Adm. Conley is Commander, Mine Warfare Command (COMINEWARCOM).

Maneuver Warfare and *Mine Countermeasures*


(Stephen Batiz/USN)

Editor's note: The following is a **draft** *of "Concept for Future Naval Mine Countermeasures in Littoral Power Projection" developed by Naval Doctrine Command in coordination with Marine Corps Combat Development Command.*

A National Security Strategy for a New Century states that the U.S. military plays an essential role in building coalitions and shaping the international environment through means such as the forward stationing or deployment of forces, defense cooperation and security assistance and training and exercises with allies and friends. This role requires significant forward presence involving naval forces in often crisis-prone regions.

Forward presence and engagement are themes of *Joint Vision 2010* (JV 2010), which is supported by the Navy and Marine Corps concepts: *Forward ...From the Sea* (FFTS), *Navy Operational Concept* (NOC) and *Operational Maneuver From the Sea* (OMFTS). A common thread among these concepts is a clear requirement to maneuver naval forces from the sea into the littorals.

The Marine Corps concept, OMFTS, envisions the use of the sea as maneuver space to project combat power ashore. With the shift in focus by naval forces from the open-ocean strategies of the Cold War to the littoral regions, the potential for mines to frustrate naval plans has increased. Naval forces must have an effective MCM capability to operate in distant waters in the early stages of regional hostilities, protect vital follow-on sealift, allow swift ship-to-objective maneuver in littoral power projection operations and conduct follow-on clearance or humanitarian operations.

The Navy/Marine Corps team has transitioned from *legacy* MCM operations which focused on port break in/out to operations involving *expeditionary* MCM in forward operating areas — "littoral MCM." MCM in littoral power projection will facilitate maneuver warfare by providing a capability to apply strength against weakness. This capability requires the ability to identify and exploit such weakness. Rather than pursue an attritionist approach through cumulative destruction, the commander must subject the enemy's mines and obstacles to rigorous surveillance and reconnaissance in order to locate and avoid them altogether or maneuver through existing gaps.

When avoidance is not an option and adequate gaps are not readily identifiable, rapid, in-stride breaching of the enemy's mines and obstacles will be conducted. *Organic* MCM will provide forward-deployed naval forces the capability to accomplish mine detection, classification, identification, avoidance and when necessary, neutralization. Supporting MCM will be able to reinforce, as required, when the mission demands a capability beyond the capacity of organic systems.

Naval forces must have an effective MCM capability to operate in distant waters in the early stages of regional hostilities, protect vital follow-on sealift, allow swift ship-to-objective maneuver in littoral power projection operations and conduct follow-on clearance or humanitarian operations. *(Jonathan P. Guzman/USN)*

Future Scope

Future operations will place a premium on highly mobile naval forces with responsive, accurate and tailored MCM capabilities continuously available to the naval force commander. Current MCM capabilities will not satisfy the requirements of the future battlespace — they are limited by lengthy timelines for surface assets to arrive in theater, inadequate integration of assets, minimal reconnaissance means and operational pauses created by the slow, deliberate nature of MCM operations. Today, these operations utilize inadequate communication and computer systems, employ dated and simplistic tactical decision aids (TDAs) and are generally only conducted in relatively benign environments under non-hostile conditions. The significant advantages of surprise and relative operational speed are lost. Limitations in U.S. capability to conduct truly rapid breaching can cede tactical advantages to the enemy.

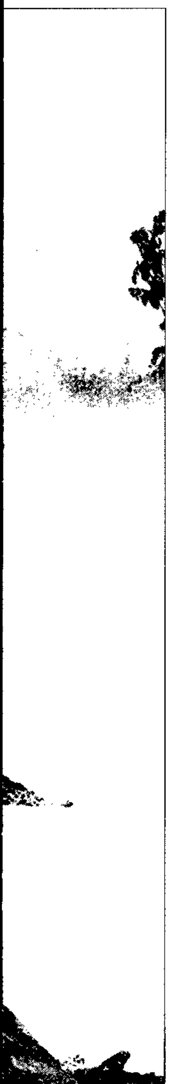
This concept examines future operational capabilities. It considers the level of hostilities from crisis through war, across the range of military operations and throughout the battlespace. The concept focuses on considerations and factors that affect MCM in support of operations in the littorals and briefly discusses five plausible mine threat scenarios:

- Transiting the Sea Lines of Communication (SLOC)/Choke Point,
- Ship to Objective Maneuver (STOM) — the seamless transition of operations from deep-water to the objective inland,
- Carrier Battle Group (CVBG)/Amphibious Ready Group (ARG)/Marine Expeditionary Unit (MEU) Operating Area,
- Operations in support of port break-in, break -out and clearance, and
- Independent Operations.

Anticipated Threat

In the future, the United States must be prepared to face a range of mine threats potentially far more lethal than those available today. More than 48 of the world's navies have mine-laying capabilities and access to mine inventories. At least 30 countries are actively engaged in the development and manufacture of sophisticated new mines. Of these, 20 are known mine exporters. An even greater number of nations possess the ability to lay land mines. Although most of the world's stockpiled mines are relatively old, they remain lethal and easily upgraded. Often described as "poor man's artillery," mines present a significant threat on land, the beach and in waters shallower than 300 feet. This location is where the greatest number of mines are most effective and where power projection missions require that U.S. forces operate.

Threat nations may field advanced mines on their own, bypassing traditional development cycles by adapting market technologies to their needs, often with the specific goal of defeating U.S. objectives. They likely will mine choke points, interrupt SLOCs and use mines and/or obstacles in protective and defensive fields as



counter-mobility weapons at anticipated landing or port break-in sites. Minefields will be laid on land, in deep to shallow water and in conjunction with obstacles in very shallow water, in the surf zone and over the beach. These defenses will be an integrated part of an adversary's overall plan.

The ability to strike with little prior notice will remain a critical requirement for future naval operations. Littoral minefields demand significant attention and resources to avoid their restricting or disrupting the ability to maneuver at or from the sea. Although there will be some mines with improved capabilities, the greatest threat will be sheer numbers rather than technological sophistication. Mines developed during the next 15-20 years will incorporate improvements, including:

- cheap and widely available electronics and microcomputers allowing improved signal processing and logic capabilities, a reduction in firing mechanism volume and power consumption,
- application of modern signal processing techniques and the development of more sensitive influence sensors allowing a larger threat radius and greater target discrimination,
- increased explosive density, providing greater lethality, especially in propelled warhead mines,
- resistance to MCM using vehicle/ship counters, unconventional shapes, anechoic coating on mine cases, a reduction in metallic materials, active mine burial systems to reduce mine target strength, hardened mine casings and blast resistant fuse designs, and
- increased operating depths on land and sea, increased use of wireless or acoustic link remote control, longer ranges and improved guidance during attack for propelled-warhead mines.

Mine Effects

Although mines attack individual targets, their effects can be far-reaching. In practical terms, a force might be compelled to modify its course of action due to the perceived or actual presence of mines.

Successful MCM provide U.S. and combined naval forces the ability to maneuver and protect seaborne forces and logistics assets critical to accomplishing the mission. While successful MCM alone will not ensure mission accomplishment, the disproportionate effect of a single mine strike might be enough to threaten mission accomplishment. Some examples of the potential impact of enemy mining operations include the loss of or delays in the arrival of:

- carrier based air power,
- amphibious assault forces,
- equipment and supplies pre-positioned afloat or ashore, or
- logistic support carried on either naval or supporting commercial vessels.

Environment

The complex littoral environment, with its dramatic variability, exacerbates the problems and challenges associated with MCM battlespace knowledge. The diverse physical operating environment — above and below the water's surface and over the land — provides the foundation of MCM planning, preparation and operations.

There are numerous geophysical parameters

to consider when operating in the littorals — shortened scales of temporal and spatial variability are common to both the oceanic and atmospheric littoral regions. For example, major causes of variability in the littoral include ocean fronts, fresh water runoff, synoptic and local weather disturbances, sea and/or land ice and tidal fluctuations.

These phenomena make it very difficult to accurately observe and forecast environmental parameters and most importantly, to predict their effect on sensors, and thus military operations, especially MCM.

Future Operations

Military forces of the future will fight in conflicts ranging from major theater war (MTW) to smaller scale contingencies (SSC). Naval forces often will be on the leading edge of such operations as they combine strategic mobility with maneuver to significantly expand the battlespace.

In a mine threat environment, MCM are key enabling activities. They must be given high priority and must be fully integrated into planning. Such planning will ensure the commander is able to maintain the flexibility that freedom of maneuver provides. Organic MCM, integral to the forward-deployed force, will be capable of spanning the range of military operations. It must be equally effective at negating the impact of a mine threat on a dispersed force or forces operating in close proximity. Supporting forces primarily will be required for large area clearance when the battlespace permits, as well as for follow-on MCM operations. Furthermore, long term MCM plans will include the development of coalition MCM forces as force multipliers to U.S. efforts. In all theaters where mines pose a threat, allied forces will be engaged to promote the establishment of multinational MCM task forces. In the future, theater commanders must include allied forces in combined MCM exercises in order to exchange tactics and philosophies, with the ultimate goal of building a more capable overall MCM force.

Command Considerations

Mines and obstacles clearly have the potential to hinder the commander's ability to accomplish the mission. They will be used to slow or stop military operations and provide a means to control military and commercial traffic flow.

To accomplish the mission, the commander must know the role that mines and obstacles play in the enemy's overall offensive/defensive plan. The commander must be aware of avoidance techniques, the force's MCM capabilities and self protective measures (SPM). The commander must judge whether the operational advantages accrued from crossing into a mine danger area (MDA) outweigh those anticipated from inaction or avoiding the minefield altogether. To meet that challenge, the capability must exist

to readily reconnoiter, collect and disseminate intelligence and mark or designate MDAs. This detailed knowledge must be gathered through early, sustained and clandestine MCM reconnaissance. In certain cases, the commander may be given no alternative but to breach a minefield and perform limited clearing operations in support of the overall concept of operations. In some smaller scale contingencies, the objective may be to clear *all* mines.

MCM Tasks and Infrastructure

MCM support will enable the commander to accomplish the mission. The MCM concept forms the basis for the MCM infrastructure (organization, materiel, doctrine, education and training, leadership and quality personnel) and MCM-focused tasks (the individual actions required to successfully complete the MCM mission), which build upon each other to provide naval forces the capability to counter the mine threat. MCM tasks can be grouped together under four general types:

- Self-Protective Measures (SPM) (described as the measures taken by all vehicles/platforms to reduce the risk from mines while in a mineable area),
- intelligence preparation of the battlespace (IPB) — mapping, full environmental survey and intelligence collection operations,
- deterrence and prevention — forward presence, preemption and interdiction.
- surveillance and reconnaissance operations (search, detect, classify, discriminate clutter and identify mines or non-mine, mine-like bottom objects (NOMBOs) leading to clearance, breaching or avoidance, and

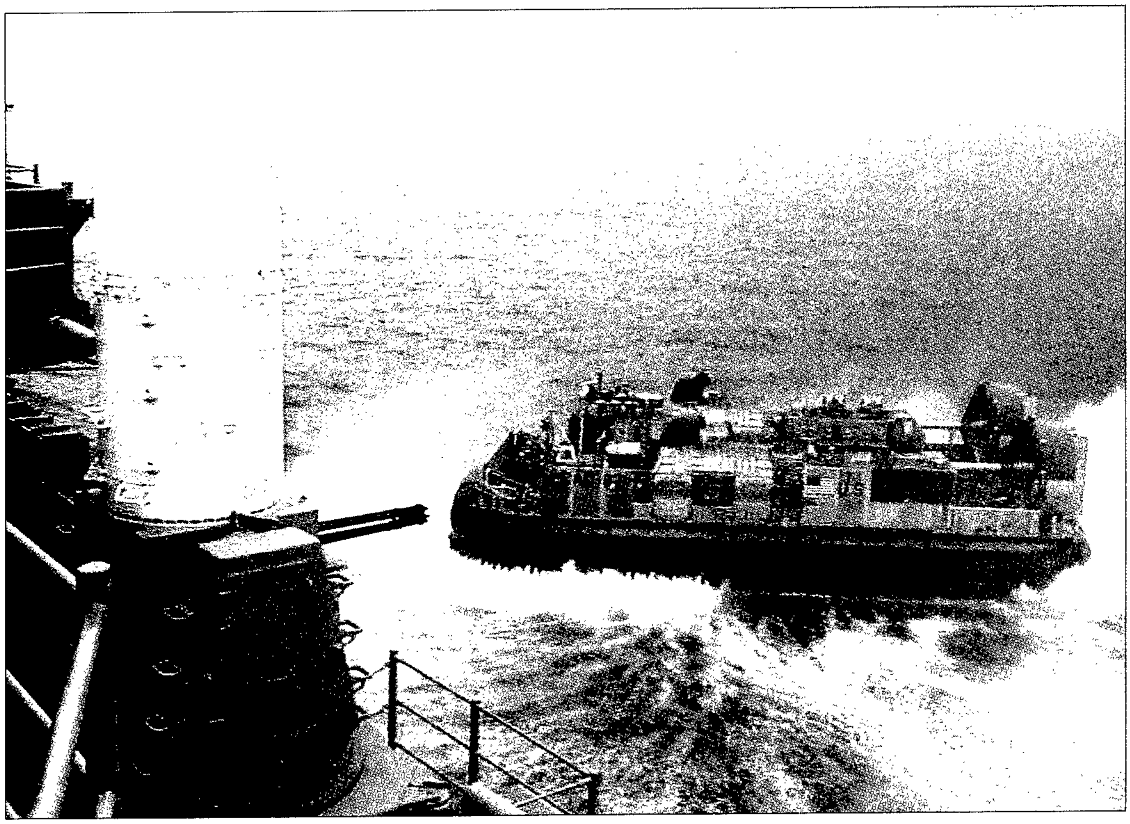
The backbone of the hierarchy is command, control, communications, computers and intelligence (C4I). Each group of tasks is continuously enabled by the previous group and tends to focus increasingly on a smaller geographic area. Tasks are not conducted in isolation. They can be compressed, blurred or simultaneous, and are integrated with the most critical needs and requirements of commanders at all levels.

Effective MCM requires a highly tuned and focused infrastructure. To sustain the force and instill operational concepts, high-quality people will be a key ingredient for success. The judgment, creativity and fortitude of our people will remain the key to success in future MCM operations. Turning concepts into capabilities requires adapting leadership, doctrine, education and training, organizations and materiel to meet the high tempo, high technology demands of the future battlespace.

C4I is the pillar that supports the infrastructure and operational tasks. It involves inputs and outputs to and from the entire force. The commander will require the ability to integrate the MCM battlespace picture derived from a wide range of sources, platforms and sensors. Deconfliction and execution of MCM tasks will require a highly automated command, control and communication system and tactical aids for planning.

Commanders at all levels require a shared awareness of the battlespace through synthesized data gathered from near and real-time surveillance and reconnaissance systems, historical records, strategic and tactical intelligence and environmental and mapping systems.

The C4I system must provide the necessary connectivity with other ground, air, naval, joint, combined or allied forces and should provide a real-time interface with national and theater sensors to ensure timely and accurate exchange of information. Of particular importance is the system's ability to support integrated MCM and amphibious operations with the rapid dissemination of mine, obstacle, NOMBO/clutter positions and their neutralization status. It will require extensive use of global precision positioning technology.



The capability must exist to readily reconnoiter, collect and disseminate intelligence and mark or designate mine danger areas. *(Ken Pace/USN)*

Self- Protective Measures

SPM must be available to all forward-deployed and supporting forces. Integral to future platform design will be the requirement to:

- manipulate the platform's signature (e.g., visual, infrared, acoustic, magnetic, pressure or seismic) to reduce the probability of mine actuation or to jam sensors at a safe range using on- or off-board systems,
- harden selected seaborne and amphibious units against mine detonation effects and
- detect, avoid or neutralize mines allowing platforms to maneuver through, or exit a mined area. For certain platforms, this requirement may mean clandestinely.

SPM are not the solution to the mine problem. However, the development of these systems remains imperative. If the situation dictates, naval forces must be able to maneuver at risk in mine-threat environments before any form of mine reconnaissance has been completed. Follow-on noncombatants and military sealift units are unlikely to be fitted with SPM.

Intelligence Preparation of the Battlespace

Environmental and Global Geospatial Information Systems support in the littorals requires:

- high resolution, multispectral geographic, bathymetric, oceanographic and atmospheric data collection for use by forward-deployed naval forces and also at a central site for study and analysis,
- remote and in-situ sampling systems and sensors that measure tactically significant data,
- computer models that rapidly develop tactically relevant assessments and forecasts, coupled with tactical decision aids (TDAs) to enhance operator understanding of the battlespace and
- environmentally adaptable combat system sensors.

Intelligence derived from a combination of human sources, as well as traditional and nontraditional sensors and platforms will be essential. Improved national, theater and tactical sensors, processing and analysis are required to assess enemy mining intentions, capabilities, locations of mines and barriers and the composition of overall defenses. The results of these efforts may reside in a number of different data bases, all of which must be assessed, fused and distributed to the tactical commander.

Deterrence and Prevention

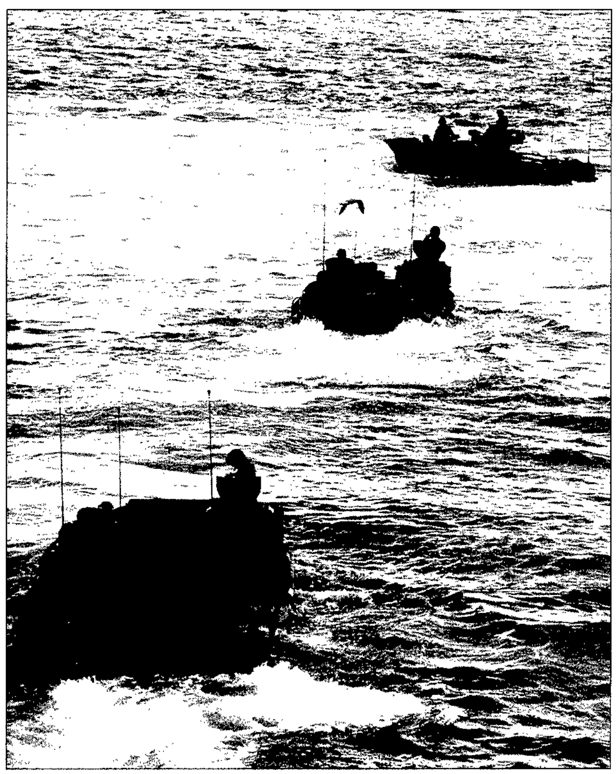
Forward presence operations are a form of deterrence. They allow peacetime intelligence collection to assess the threat and accurately monitor the operational posture of potential adversaries by identifying mine stockpiles and dispositions of mine-laying forces. Furthermore, MCM training and exercises must be conducted to convince potential adversaries that U.S. MCM capabilities are formidable and can readily prevail.

Preemption exploits an adversary's need to base mine-laying forces and infrastructure at fixed locations. Preemption may employ both lethal and nonlethal technology and may seek to either deny the use of mines or the ability to effectively deploy them. Prevention can take the form of neutralizing enemy mining capabilities, denying access to critical areas for enemy minelaying forces or deception operations. When Rules of Engagement (ROE) allow, offensive measures will be a major element of initial battlespace preparations. To the degree that offensive measures can be nonlethal, they will be more politically acceptable and more likely approved.

Interdiction aims to neutralize enemy minelaying forces before they arrive in the intended areas of employment. The coordinated employment of many different sensors will be required to identify, locate and track the minelayer. Interdiction requires more assets than preemptive tactics, but may benefit from less restrictive ROE.

Surveillance and Reconnaissance

Early and sustained surveillance and reconnaissance operations are fundamental to MCM operations. They are the activities designed to make a rapid assessment of the limits and density of a minefield, or the absence of mines. If operational surprise is imperative, clandestine preparations are required. Early in any campaign, commanders require the location and extent of enemy barriers, obstacles and minefields. The identification of areas of high clutter density and exploitable areas also will be tactically significant. Development of the areas and timetables for reconnaissance actions requires a complete understanding of the intelligence picture, environment, operational objectives, timelines and the number and capabilities of MCM assets available for the task. This understanding can be enhanced through the use of tactical decision aids (TDAs) and planning tools. The conduit for this knowledge will be the C4I architecture.



The commander requires in-stride breaching systems to take advantage of surprise and initiative and to maintain momentum without causing pause or delay. *(Charles W. Alley/USN)*

There is no single-source surveillance and reconnaissance system. The commander requires a mix of MCM systems. This mix must be predominantly low vulnerability, autonomous and organic to the forward-deployed force, and provide rapid and wide-area detection, classification and identification. A near real-time assessment of the mine threat is required through computer-aided mine detection, classification and identification (CAD, CAC and CAI) techniques. These systems must be effective from deep water, across the beach to objectives inland. Autonomous vehicles should be recoverable for future use and rapid turnaround. At the unit level, maritime forces require an on-board mine detection sensor suite.

While an organic MCM capability is necessary in high threat, immediate need scenarios, supporting MCM platforms and systems must be available for preparation, follow-on operations, post-conflict operations and large areas (e.g., carrier battle group operating areas) when battlespace dominance is attained and time is not critical. The commander may require large area and total mine clearance in scenarios such as smaller-scale contingencies and humanitarian mine clearance without encumbering or distracting other combatants from their mission.

Clear, Breach and Avoid

Following the identification and precise location of mines, the commander must decide, based on the operational situation, to either destroy the mines or mark for tactical avoidance. Mine clearance operations (designed to clear or neutralize all mines and obstacles from a route or area) require autonomous systems organic to the force. These systems must have a high degree of assurance and must be integral to the mine detection and identification platform for rapid 'search to destruction' of the mine threat.

Other mine clearance techniques are required, such as influence sweeping or jamming. These techniques may be required in areas where sensor searches are inefficient, typically due to the environmental conditions (e.g., clutter density) or mine burial.

Follow-on forces require similar mine clearance systems that provide a higher priority to 'total' mine clearance (zero tolerance in a humanitarian scenario). It is acknowledged that this clearance will take a longer time and require supporting forces.

The commander also requires in-stride breaching systems to take advantage of surprise and

initiative and to maintain momentum without causing pause or delay. These systems will be used by assault forces and must be effective against a wide range of mine threats from deep water through to the objective ashore.

The following scenarios briefly exemplify the threat that may be faced by forward-deployed forces. In each case, the problems associated with the scenario are different, but equally challenging. The MCM tasks described above are relevant to each situation, but the difficulties of the problems in each vary. For example, surveillance and reconnaissance in a strait may be confined to a limited area when compared to an operating area, which may be thousands of square miles. Equally important to all, however, is intelligence preparation of the battlefield. The commander needs to know whether an adversary has laid mines (the location, density and type), which areas are absent of mines, and just as importantly, the impact of the environment.

Sea Lines of Communication

The SLOCs, in particular the geographically constrained areas such as choke points, narrows, straits and estuaries around the world, are easy and obvious targets for mining activity. Naval forces must be able to transit these high threat routes to demonstrate presence as hostilities escalate and position for forward operations and power projection. MCM operations will have added imperatives if timelines are shortened and a high speed transit is necessary to meet operational demands. One method to allow for a higher speed of advance (SOA) is the use of off-board organic MCM sensors ahead of the force. Mines will be neutralized or electronically marked for avoidance to allow the safe passage of following forces.

Ship-to-Objective Maneuver

STOM is the tactical implementation of OMFTS. It incorporates the philosophy of maneuver warfare, which is based upon pitting strength against the enemy's weaknesses by avoiding defenses and exploiting gaps. STOM is a radical departure from the traditional linear approach to amphibious operations. In STOM, the landing force will have the freedom to launch its attack from over the horizon at sea, well beyond the range of enemy direct fire weapons. Elements of the landing force will maneuver during the approach to the beach under the orders of their tactical commanders, just as they would if attacking on land. Commanders of landing force subordinate units will select specific littoral penetration points for their individual units — based on the changing tactical situation — even as they approach the shore.

In STOM, surprise is critical to success. Unlike traditional amphibious operations which are typically preceded by lengthy and deliberate battlespace preparation, to include mine/obstacle reconnaissance, marking, breaching and clearing, STOM operations will be planned to achieve tactical surprise. Any pre-assault preparations will be performed clandestinely; many of the functions traditionally performed prior to the amphibious assault will be conducted "in stride."

The ability of naval forces to safely transit to, and operate in, a dedicated area ensures the flexibility of projecting power. *(Neil H. F. Sheinbaum/USN)*

STOM presents special challenges for MCM operations. The goal is to streamline the existing deliberate sequence of MCM actions to achieve a capability which will support rapid maneuver by the landing force at sea, as well as on land. Elements of the landing force may be required to conduct mine and obstacle breaching from deep water, through shallow water, very shallow water, the surf zone and on to objectives located well inland. In STOM, the landing force cannot be constrained by a requirement to attack along prescribed lanes, as in traditional amphibious operations. Elements of the landing force must possess the freedom of action to maneuver at will, both at sea and on the land, either avoiding mines and obstacles or conducting very rapid in-stride breaching operations.

Operating Areas

The ability of naval forces to safely transit to, and operate in, a dedicated area ensures the flexibility of projecting power when and where the commander desires. Depending on the geography, operating areas may be vulnerable to mining. Furthermore, the risk of actuating influence mines increases considerably when multiple ship passes are likely within a constrained area. For this reason, early MCM preparations will be required using advanced deployment of autonomous, off-board organic MCM platforms. This is necessary to ensure the operating area is thoroughly searched and/or cleared and marked before the main force arrives. Organic MCM assets will continue to search and monitor the area after the main force arrives. If the battlespace environment and time permit, supporting forces will be used to augment organic assets by conducting reconnaissance and clearance operations ahead of, and when the naval force arrives.

Port Break in/out Operations

An opposed port break-in presents great risk, especially against a well-prepared and equipped opponent. Consistent with the tenets of maneuver warfare, ports may be neutralized or even seized by the use of other more efficient and less costly means. Nevertheless, a port break-in operation is conceivable, especially against a less sophisticated, poorly equipped and untrained adversary.

Organic MCM forces are required to support the port break-in and break-out operations. The location of the port, assessment of the mine threat, the critical need for U.S. naval forces to be underway and immediate availability of organic or supporting MCM forces will determine the commander's courses of action. In a relatively benign environment, such as the terrorist mining of a harbor entrance, initially organic and then supporting MCM forces can be used to establish a precise navigable channel clear of mines. The certainty that all mines have been cleared or that a safe channel has been established will be at the expense of time.

When port mining is tied to other events, for example, to blockade a strategic objective or in an effort to bottle up forces, the need to get U.S. forces underway may override the mine clearance confidence factor. The commander will use the force's organic MCM assets for mine detection and neutralization, calling forward immediately available supporting MCM capability to assist in clearing a channel sufficient to enable the force to deploy as soon as possible.

Independent Operations

For naval forces, there will be missions which require dispersal away from the main force for

independent operations (e.g., theater missile defense, naval surface fire support, TLAM strike, special operations forces (SOF) insertion and noncombatant evacuation operations). Since the focus of these operations will be away from the main force, the MCM assets provided for mine reconnaissance, avoidance and limited clearance must be those systems organic to the individual unit conducting the mission.

Supporting MCM assets may be neither compatible nor available for the mission. Preparation tasks will be essential; independent operations emphasize the need for MCM-focused environmental and intelligence assessments to be available to all naval forces. Furthermore, compatibility for a particular mission requires that selected units within a naval force have off-ship organic mine detection, avoidance or neutralization systems in addition to an on- board detection and classification sensor suite for close-in mine avoidance.

Future Operational Capabilities

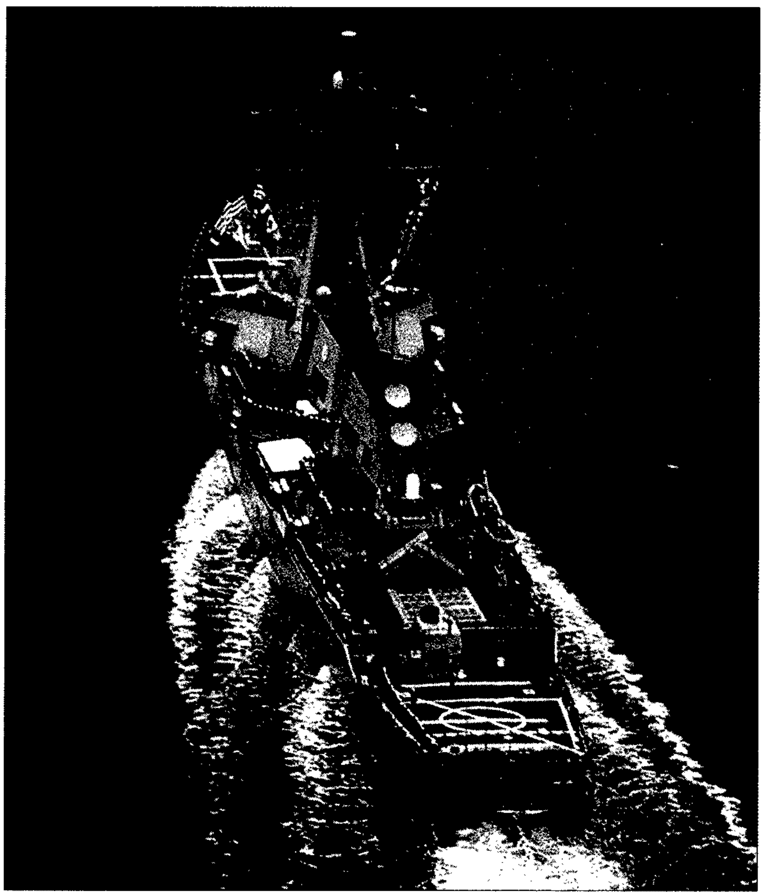
U.S. forces must be able to significantly reduce the *time and risk* of conducting operations in a mine threat environment to an easily interpreted and straightforward "GO/NO GO" criteria. They must have the capability to support the commander and rapidly overcome operational pauses resulting from mines.

There is no simple solution to enemy mining. Naval forces must develop and integrate innovative technologies, platforms and sensors, and exploit the environment through a focused and streamlined infrastructure.

As the onus of the MCM mission migrates from purely supporting MCM forces to a combination of organic and supporting forces, MCM education and training must evolve in two distinct and equal directions and in tempo with the development and deployment of innovative systems.

Future MCM systems will employ state of the art technology. Consequently, extensive training will be required to operate and maintain these systems and understand the new technologies. Unit and force level training also must evolve. MCM training in the future should:

- ensure that fleet units, both supporting and organic, carry out all MCM tasks against difficult training targets in real-world, less-than-favorable littoral environments,
- emphasize multiplatform, cooperative MCM tactics, integrating land, air, surface and subsurface MCM assets into appropriate fleet exercises,
- stress the use of C4I systems and computerized TDAs,
- exploit modern simulator technology to train individual crews,
- link simulators and deployed naval platforms to practice coordinated operations in environments that match as closely as possible the situations forces will face during operations ranging from crisis to high intensity conflict, and
- integrate MCM into battlegroup training for other littoral warfighting operations with portable, real-time linked minefield training ranges.



Since some independent operations will be away from the main force, the MCM assets provided for mine reconnaissance, avoidance and limited clearance must be those systems *organic* to the individual unit conducting the mission. *(Robert Sitar/USN)*

Current MCM doctrine has not changed significantly from that used during World War II. The operational situation of future naval power projection forces may reduce significantly the time available to MCM forces to accomplish their missions. Organic MCM forces must be closely integrated with, and continuously provide information to, the commander. This integration will place an enormous reliance on a variety of autonomous platforms and sensors.

These differences will make future doctrine noticeably different from that of today and will mandate MCM doctrine be developed, evaluated and revised as experience, systems and operations evolve.

Future operational capabilities should focus scientific and academic communities on solving the mine problem. Low cost, reduced life-cycle support, user friendliness, commonality, modularity and efficiency should be the bywords. Military applications must be grasped from nonmilitary, commercial and academic research and development of emerging systems.

Commercial enterprises and nonmilitary agencies worldwide continue to use developing technologies in new and innovative ways. Government or commercial off-the-shelf (GOTS/COTS) technologies lead to lower costs, as well as shorter development and acquisition times.

The availability of such systems for exploitation by an adversary also must be recognized as a vulnerability. Historically, countermeasures appear soon after any new technology is first used or revealed. Thus, over time, any perceived advantage is negated.

With the wide dissemination and availability of the battlespace picture, the commander will have to communicate updated intentions as the situation rapidly changes. To take advantage of short-lived opportunities presented, the organization must be highly responsive, interoperable and adaptive to changes in intent. The trend towards increased flexibility, high mobility and flatter organizations with enhanced C4I will result in many traditional staffing processes being performed through reachback. As organic and supporting systems and C4I are introduced to naval forces, the naval and MCM organizations must adapt to employ them. Effective C4I must allow MCM functions to be performed from a variety of plat-

forms within a highly dynamic environment.

Technology, Research and Development

Shared awareness is critical. A robust, real-time, joint and combined, capable C4I system architecture will be central to coordinated, multiplatform operations. C4I connectivity enables all relevant forces to respond to contacts, integrate collective knowledge and best exploit their capabilities. The C4I architecture will be continuously "networked" to:

- ensure communication paths always exist between each platform or detachment despite uncertain point-to-point links,
- provide local commanders and detachments all the information they want ("pull" information) at the right level of detail, and
- provide relevant local information to all commanders as their circumstances change ("push" information).

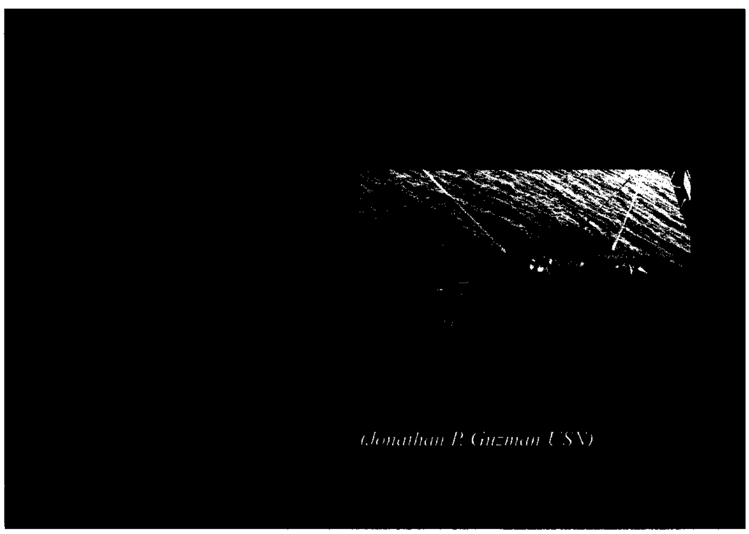
Commanders must have access to all relevant sensor data in their current or projected area of operations. Friendly force and environmental information must be available so commanders can optimize their tactics and sensor systems' performance. The volume, variety, time-sensitivity of the data and its multiple sources all increase the importance of managing it correctly. Naval forces will require shared awareness through:

- a network that collects and displays all appropriate intelligence, surveillance and reconnaissance sensor products and environmental data; and
- management tools that:
  - automatically perform contact management on target mines, mine like objects and obstacles from multiple data sources with a high degree of accuracy using environmental, bottom mapping and contact data bases,
  - accurately exchange data in real time for all sensors and platforms in theater,
  - provide a concise and accurate summary of the battlespace using a common geo-reference system in real time,
  - generate MCM mission plans, and
  - rapidly share all MCM information among all platforms.

The capability must exist to exploit the battlespace environment, from the upper atmosphere to the sea floor, in real or near real-time. The environmental impact on operations in the littoral is so significant that without a thorough description of the battlespace, successful outcome is in jeopardy.

Environmental data will be collected by a variety of sensors. These sensors will be integral to manned or autonomous space and airborne platforms, ground and surface/subsurface units. These sensors may be surface/subsurface devices that are expendable, small, cheap and scatterable. The capability to assimilate the gathered data into a precision physical, biological, optical and acoustic high resolution model for real-time environmental assessments, as well as forecasts, will be required. The processed data also must be coupled to the common tactical database and TDAs. Database tools will include such features as high resolution environmental mapping from sparse data and explicit simulations to be used for detailed operational planning, training and rehearsing.

During future MCM operations, decision aid software and the force's common environmental picture will be driven by fused data from extensive multisource collection and analysis efforts, off-ship forecasts and the historical environmental database. Finally, an effective communications network with accurate positioning in the air, on the ground and underwater is a key technology issue.


(Jonathan P. Guzman USN)

Sensors and weapons must be environmentally adaptive. Sensors and systems require the capability to measure environmental parameters, use the data in modeling and mission planning, and immediately optimize MCM sensors automatically or through operator intervention.

MCM Sensors and Platforms

Coordinated, multiplatform MCM operations optimize available sensors and systems, regardless of the host platform, to ensure that the most effective is used when and where it is most needed.

Fundamental to the MCM concept are early and accurate surveillance and reconnaissance techniques to rapidly and efficiently locate mines and minefields, and identify areas where mines are not present. This identification will require detection of mines or enemy mine laying activity anywhere in a large area spanning thousands of square miles. If U.S. or allied naval forces maneuver or operate in dispersed formations, the mine search area will increase several-fold. Effective surveillance and reconnaissance will rely on some form of cueing (normally from intelligence sources) to concentrate the search or, in the worse case, a datum established from a casualty.

Rapid and wide-area detection, classification and identification of mines, for avoidance, clearance or breaching is critically dependent on platform characteristics. Future platforms require high performance capabilities in terms of speed, precision navigation, self-protective measures, range, endurance, communications and sensor payloads, mission turnaround time and, in the case of off-ship systems, the 'footprint' within the host platform. An important consideration will be the autonomy of the system and the constraints it puts upon the host platform's ability to conduct other warfare missions. The mix and numbers of organic MCM platforms and sensors required to achieve mission accomplishment must undergo rigorous analysis, experimentation, modeling and simulation.

For large area operations, post-conflict operations, or when organic assets are not available, supporting MCM forces must be available to the commander within a specified period.

The harsh littoral environment markedly reduces effectiveness of mine search and targeting sensors. This degradation is dramatic in the surf zone and riverine areas. Successful detection, classification and identification of mines requires environmentally adaptive sensors, capable of overcoming poor signal-to-noise ratio at a significant standoff distance. Future sensors require high reliability and performance in processing speed, false alarm rate, sensor search rate (area coverage), positional accuracy and in-situ environmental sensing.

MCM sensors must have the capability to conduct on-board (man out of loop) rapid mine detection, classification and identification. As the need for high-speed maneuver increases, mul-

An organic, in-stride mine and obstacle breaching capability is required for the landing force to facilitate rapid transition from deep water to the shallow water, surf zone, over the beach to inland objectives. *(KenPace/USN)*

tispectral MCM sensor capabilities must be expanded for full integration with maneuvering forces. Sensors must have sufficient fidelity to quickly and automatically discriminate clutter and NOMBOs from real mines. It is essential that the system capabilities offer very high reliability and confidence factors to support mission objectives. Furthermore, these sensors must be developed to provide rapid feedback to the operator on his performance and platform vulnerability.

The commander must have the capability to confidently avoid mines or achieve the assured destruction or neutralization of a mine threat in the absolute minimum time. These systems must be effective against buried, ground, moored or floating mines from the deep water to the anti-invasion mine on the beach and the antitank or antipersonnel mine on land. Furthermore, confidence that the "job has been done" requires the capability to relay accurate battle damage assessment.

An organic, in-stride mine and obstacle breaching capability is required for the landing force to facilitate rapid transition from deep water to the shallow water, surf zone, over the beach to inland objectives. The capability to expand the breach also is required to allow for sustainment and follow-on forces. Supporting forces and selective organic platforms will have the capability to deploy autonomous vehicles to neutralize mines using a variety or combination of methods such as influence sweeping or other techniques. In some instances, these vehicles may be used to conduct wide-area "influence jamming" to allow the safe passage of vulnerable units.

SPM will not overcome the threat, but form part of the hierarchy of MCM tasks required to combat mines. While individual units must be able to operate autonomously and have the ability to use organic sensors to detect, classify and identify mines, the risk in a high mine-threat environment of a 'leaker' is always possible.

Selected platforms must have the capability to maneuver through a mined area using detect and avoid sensors and possess a limited clearance capability to be able to free themselves when trapped within a mined area. All combatants must have the capability to employ stealth — to manipulate unit signature and avoid triggering mine actuation. Signature control must improve to the point where mine actuation by a military unit rarely occurs.

Seaborne and some amphibious assault craft and land vehicles require the ability to withstand and resist the damage of a close proximity mine detonation. This may include methods such as improved construction, shock hardening for equipment and machinery, and protective materials.

Maintain Momentum

The commander of the next war will not have the equipment and assets of previous commanders nor will he have the time (reduced now to hours and days vice weeks) to conduct MCM to detect, identify and breach or clear an enemy minefield that may be more sophisticated than that faced in the last war.

Mines are inexpensive weapons which have dramatically demonstrated the ability to stall, disrupt or thwart a naval force — a strategic victory for the adversary. Following a conflict, the mine layer replenishes stockpiles, an attractive option when compared to more costly sophisticated weapons. Little if anything changes; the advantage remains with the mine layer. Mines will be used in the next conflict; they remain a serious threat to U.S. forces.

A final version of this paper can be found at Naval Doctrine's website — **http://ndcweb.navy.mil/concepts/mcm/mcm.htm**.— *upon final approval. Point of contact is Cmdr. Brian Warren, RN (N811)*

SURF ZONE TECHNOLOGY

by Daniel A. Crute

The global changes in this decade, along with the Navy's experience in Operation Desert Storm, have led to a fundamental reshaping of national military strategy. Naval doctrine is changing to reflect this reshaping and define a new role for the Navy in military strategy of the future. *...From the Sea* and *Forward ...From the Sea* begin to articulate the new Navy role. These documents emphasize power projection from the sea as part of a new focus on expeditionary warfare.

The thrust toward expeditionary warfare has led to a new emphasis on littoral warfare recognizing the need to rapidly cross the littoral region with a power projection capability. The Marine Corps' concept of *Operational Maneuver From the Sea* (*OMFTS*) provides the means for accomplishing this rapid movement from sea to shore. The concept emphasizes swift maneuver from over the horizon, through the surf and beach zone, to objectives ashore. An amphibious assault no longer will be a slow, deliberate operation with high attrition and a massive buildup of combat power on the beach. The fluid, dynamic operational maneuver will move swiftly through the littoral region and on to inland objectives.

Breaching the Surf Zone

The proliferation of mines in today's world presents a formidable challenge to the successful accomplishment of the *OMFTS* concept. Mines provide a cheap, lethal threat that even the less developed nations can utilize to defend their shores against such a power projection attempt. Mines, possibly combined with man-made obstacles, can substantially restrict the mobility of forces during operational maneuver.

A clandestine reconnaissance capability will enable forces, in some cases, to exploit gaps in the defenses by going around the minefields rather than through them. However, some warfighting situations will require a capability to breach the minefields and obstacles in order to best achieve military objectives. Then, a rapid, flexible, long standoff breaching capability is needed to catch the enemy by surprise and conduct swift maneuvers through the minefields.

The surf zone includes the region from 10 feet of water depth to the high water mark. Threat mines in that region can range from small antipersonnel and antitank mines to much larger, shallow-water bottom mines. Mechanisms to initiate the mines include pressure plates, tilt rods, chemical horns and magnetic influence fuzes. Mines are often densely concentrated and may be combined with obstacle defenses. Obstacles may range from heavy concrete barriers to much lighter steel obstacles, such as concertina wire. The possibility of direct and indirect fire from the shore intensifies the lethality of the combined threat.

The wave action, currents and rapid change in the surf zone make it a difficult operating environment. The turbidity, bubble content and acoustic noise in the water combine to make a very difficult sensing environment. Many of the techniques for reconnaissance and clearance in deeper water or on land do not work effectively in the surf zone.

The Challenge

The difficulty of the threat and the environment, along with the operational constraints of *OMFTS*, lead to significant technical challenges. The Navy/Marine Corps team needs to develop technologies for effective sensing in the surf zone environment. Technologies enabling rapid, remote and accurate delivery of clearance systems from over the horizon are necessary, as well as methods to improve the effectiveness of clearance systems and optimizing clearance capability.

The Surf Zone Technology Program, sponsored by the Office of Naval Research, utilizes a dual-focus approach to address the technical challenges. One focus area concentrates on developing the knowledge base of physical interactions in the surf zone. This concentration involves testing and analysis to better understand the vulnerability of mines and obstacles and to develop explosive effectiveness models. These "knowledge base" efforts are divided into two main thrusts: mine neutralization and obstacle breaching.

The other focus area concentrates on developing innovative technologies to enable a "next generation" warfighting capability. The emphasis is on developing the rapid, flexible, long standoff reconnaissance and clearance capability that will enable operational maneuver from the sea. The focus on advanced concepts includes a concept assessment process and several areas of new technology development.

Mine Neutralization

When the Surf Zone Technology Program began in 1992, the main focus was developing computational analysis capabilities and test data bases to predict and optimize the performance of explosive neutralization systems against surf zone mines. This emphasis has continued as one of the thrusts of the program. The

mine neutralization investigations support current system development programs such as the Assault Breaching System (ABS) and technology demonstrations such as the Explosive Neutralization Advance Technology Demonstration (EN-ATD). The mine neutralization thrust includes three projects: Sand and Mine Response Models, Explosive Performance Models and Mine Vulnerability.

The Sand and Mine Response Models project is developing a computational capability to predict the propagation of explosive shock through the complex surf zone environment, which includes sand, water and entrained air, with multiple material interfaces. The computational capability is being developed by adapting increasingly sophisticated material models to hydro-codes and coupled hydrodynamic/structural analysis codes. Controlled laboratory testing and field testing provide test data for validation of the computational methods.

The Explosive Performance Models project is developing quick analysis tools for the optimization of explosive line charges and distributed explosive arrays. These models, based on hydro-code results, take only minutes to run on a personal computer, while the hydro-code models require hours on a mainframe computer. The models predict pressure, impulse and energy at points in the sandy bottom resulting from explosive shock.

The Mine Vulnerability project performs tests and analyses to determine the vulnerability of foreign threat mines to explosive shock. Threat mines vary widely in construction and initiation mechanisms. Each mine type is examined for internal mechanical details. Finite element models are developed to predict vulnerabilities and explosive tests are performed to determine actual response to shock. Vulnerability studies have been performed for pressure plate antitank mines, tilt rod antitank mines and tilt rod anti-invasion mines.

Obstacle Breaching

Rapid, remote clearance of man-made obstacles, especially when combined with minefields, poses a difficult challenge. Current tactics involve SEAL teams with satchel charges in a very difficult and dangerous mission. If obstacles are surrounded by mines, SEALs cannot go in until the mines have been neutralized.

Many of the concepts under consideration for obstacle breaching utilize explosive charges or directed-energy warheads. To better understand the effectiveness of these concepts, two projects are investigating the vulnerability of obstacles: obstacle vulnerability and bomb effects.

The obstacle vulnerability project includes testing and computational analysis to investigate the vulnerability of heavy concrete obstacles to various types of directed energy warheads. Warheads tested have included shaped charges, explosively formed penetrators (EFPs), kinetic energy penetrators and others. These warheads were tested against unreinforced concrete targets, primarily four-foot cubes. The damage rules resulting from tests and analysis will provide a tool for optimizing warheads against concrete targets.

The bomb effects project is investigating the effects of existing bombs against a variety of obstacle types. Computational analysis and testing will determine the effects of single detonations, sequential detonations and simultaneous detonations, in both air and water (surf zone depths). The resulting damage models will enable evaluation and optimization of various concepts for using guided bombs to breach obstacle bands.

Advanced Concepts

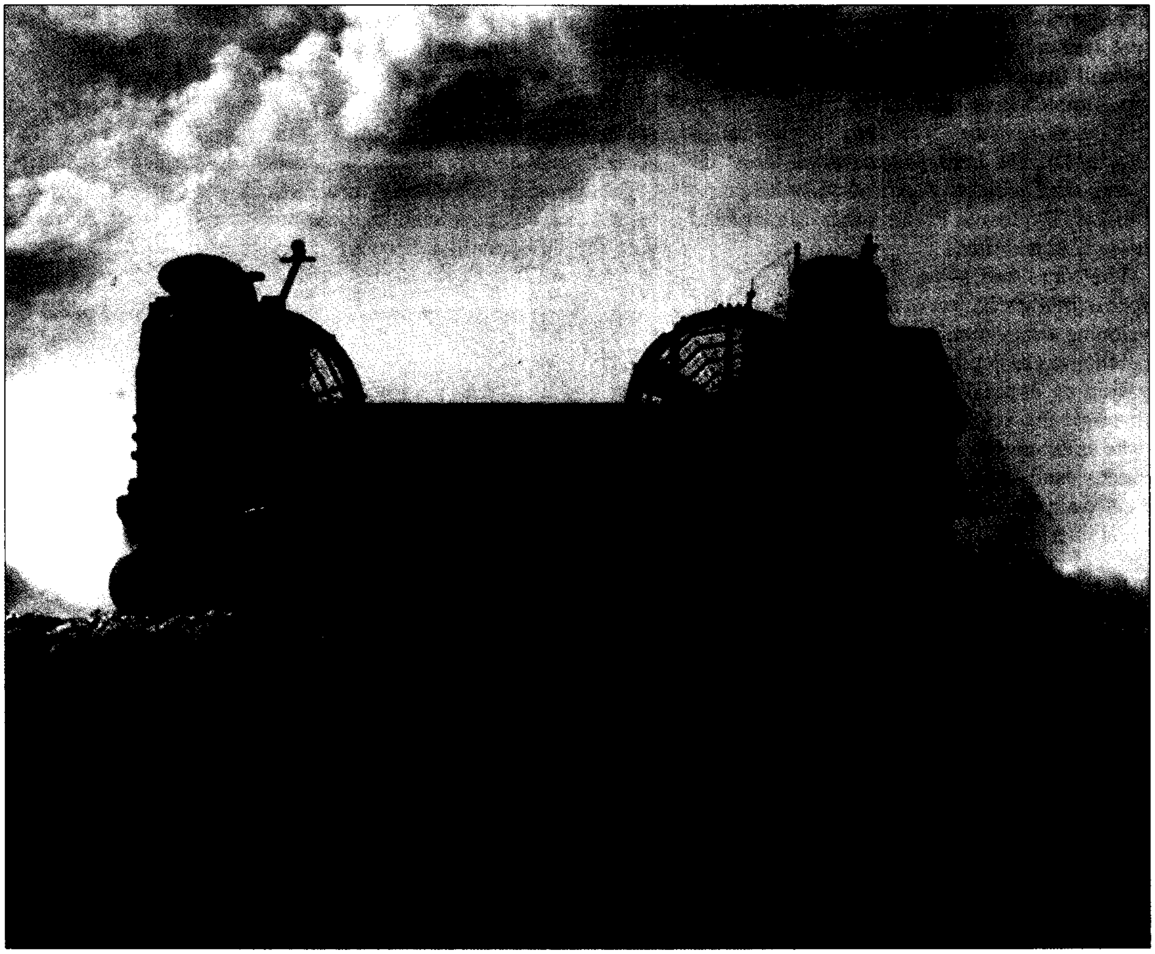
The rapid advance of technology makes possible tomorrow what can be imagined today. Throughout the history of warfare, especially modern warfare, the nation that has utilized the best available technology has gained a distinct advantage. The accelerating pace of technological advancement in the world today demands a constant look into the future to determine how emerging technologies can enhance, or revolutionize, warfighting capabilities.

The aim of the Surf Zone Technology Program is to fully enable the operational concepts envisioned for the future by the Navy and Marine Corps, such as *Operational Maneuver From the Sea. (Charles Grow/USMC)*

The advanced concepts focus area of the Surf Zone Technology Program is identifying and developing concepts that apply emerging technologies to provide a "next-generation" capability for reconnaissance and clearance in the surf and beach zones. The aim is to fully enable the operational concepts envisioned for the future by the Navy and Marine Corps, such as *OMFTS*. To accomplish that implementation, a concept assessment project was initiated in FY 96, which has led to two new projects focused on long standoff delivery and surf zone reconnaissance.

The concept assessment project was initiated to provide a systematic process for evaluating the numerous advanced concepts proposed for surf zone reconnaissance and clearance. The process includes investigations into technical feasibility and operational utility, to enable wise decisions for investment in technology development. Beginning with a broad search, the process gradually narrows the focus to technologies with the highest payoff potential.

The Advanced Concepts Steering Committee (ACSC) serves as the recommending body for the concept assessment process. Members come from a range of organizations including fleet representatives, requirements and acquisition communities and science and technology communities. The ACSC meets annually to review the latest proposals and investigations, making recommendations for the initiation of concept studies, warfare analyses and further technology development and demonstration. The committee met for the first time in June 1996 and recommended investigations into long standoff delivery of guided bombs for obstacle clearance and the use of small autonomous vehicles for surf zone reconnaissance.



A reconnaissance capability in the surf zone, identifying locations of mines and obstacles, would dramatically increase naval ability to maneuver safely through gaps or cleared lanes. *(Gerald James/USA)*

Long Standoff Delivery

Rapid improvements in precision delivery and autonomous guidance and control are converging to enable new possibilities for delivery of clearance systems from over the horizon. Several GPS-guided glider delivery concepts have been investigated in the Surf Zone Technology Program. Warfare analysis indicates that a combination of several clearance systems with guided glider delivery could clear two breaching lanes on typical beaches in approximately 30 minutes, providing a tremendous step forward toward a rapid, flexible, long standoff capability.

The long standoff delivery project is investigating technologies for delivering guided bombs from over the horizon to breach bands of obstacles. This mission combines highly accurate placement with near vertical orientation of the bomb at impact to optimize the effects of fragmentation of the bomb case. Yet, the delivery package must remain relatively low-cost to allow for the significant numbers required for a breaching mission. An analysis of options, supplemented by modeling and simulation, will determine the key technologies to pursue for enabling long standoff delivery for obstacle breaching.

Surf Zone Reconnaissance

Maneuver warfare involves the rapid exploitation of opportunities, utilizing tempo and surprise, to shatter the enemy's cohesion. A key to seizing opportunity is effective reconnaissance. The force commander who knows the defenses and the actions of his enemy has a distinct advantage.

Studies confirm that a reconnaissance capability in the surf zone, identifying locations of mines and obstacles, would dramatically increase naval ability to maneuver safely through gaps or cleared lanes. Airborne and undersea surveillance and reconnaissance capabilities are improving rapidly, but have severe limitations in the surf zone environment. A surf zone reconnaissance capability is needed to complement the existing and developing systems for wide range surveillance and reconnaissance.

The Surf Zone Reconnaissance Project is investigating technologies to enable a network of small, autonomous, bottom-crawling vehicles to perform reconnaissance operations in the surf zone. The key technical challenges are:

- sensing in the surf zone environment,
- navigation and location for small vehicles,
- communication from vehicles to the network hub, and
- vehicle stability and mobility.

This effort builds on recent technology developments in small autonomous vehicles, close proximity sensors and underwater communications. The concept involves a network of autonomous vehicles searching the surf zone with multiple sensors and reporting back or marking the locations of mines and obstacles. Such a capability will enable the incoming forces to exploit gaps in the defenses or target the existing defenses with precision-guided breaching systems.

Vision For The Future

The Surf Zone Technology Program ensures that a vision of the future supports the broader vision of the Navy and Marine Corps, as expressed in documents such as *Concept of Operations for Mine Countermeasures in the 21st Century* and *A Concept for Mine Countermeasures in Littoral Power Projection*. The technologies currently in development in the program, and elsewhere, have the potential to bring the vision to reality.

Editor's note: Mr. Crute is the technology program manager, Advanced Concepts Office, NSWC Dahlgren Division, Coastal Systems Station, Panama City, Fla.

Conquering the VSW Environment

(Stephen Batiz/USN)

Man and Dolphins on the Front Lines

by Cmdr. Dan Renwick

The Naval Mine Warfare Plan continues to emphasize the development of new capabilities required to achieve seamless organic and dedicated mine countermeasures (MCM) from the sea.

Operation Desert Storm, subsequent exercises and studies have highlighted MCM deficiencies in the very shallow water (VSW) environment (10-40 foot depth). The emergence of mines globally and the proliferation of these low-cost, lethal weapons pose a significant threat to the execution of joint littoral operations and the safety of U.S. forces.

Naval and anti-invasion mines, obstacles and a description of mine types and potential minefields, which might be employed by adversaries to counter amphibious operations, is contained in the validated threat assessment. Generally, small sea mines (both moored contact/influence and bottom influence) are likely to be used in belts within the shallow water (SW) zone and well into the VSW zone. Bottom mines, with increasingly stealthy shapes and buried in near-shore environments, further complicate the MCM task.

The diverse arsenal of VSW, including smaller surf zone anti-invasion mines and obstacles, an irregular seabed, marine growth and complex acoustics in the near-shore waters, exacerbates the MCM challenge. Furthermore, seabed content, tides and waves often cause unpredictable mine migration and burial. Typically, high non-mine bottom object (NOMBO) density in the near-shore areas also complicates the problem. For example, sunken channel buoys, cars, refrigerators, oil pipelines, etc. are frequent culprits in creating "high clutter." Thus, mines and obstacles employed to counter or delay an amphibious assault can vary widely with the inventory and ingenuity of the adversary.

The need to preserve the element of tactical surprise in expeditionary operations, and to protect the advanced force and pre-assault forces conducting MCM tasking, requires future systems to be designed to support clandestine operations. Currently, tactical deception and battlespace dominance are used to provide minimum visibility of these systems.

Highly Specialized Force

Recognizing current MCM limitations in the VSW zone, the director of Expeditionary Warfare (OPNAV N85) began the VSW MCM initiative in FY 96 to develop and maintain a VSW MCM capability. The Chief of Naval Operations officially established the VSW MCM detachment under Commander, Mine Warfare Command. Commander, Explosive Ordnance Disposal Group One exercises administrative control over this small, unique and highly specialized MCM force at Naval Amphibious Base, Coronado in San Diego.

The VSW MCM detachment consists of three subordinate platoons: a VSW diver platoon, a Marine Mammal System platoon and an Unmanned System platoon. Today, the detachment consists of four officers and 38 enlisted personnel composed of Explosive Ordnance Disposal (EOD) divers, U.S. Navy SEAL combat swimmers and U.S. Marine Corps force reconnaissance personnel.

The mission of the VSW MCM detachment is:

- to develop tactics, techniques and procedures for low-observable mine reconnaissance and obstacle neutralization,
- to identify VSW MCM requirements for achieving and sustaining a permanent core contingency response capability to conduct VSW MCM, and
- to evaluate prototype VSW MCM systems and equipment.

One of the more intriguing VSW MCM activities is the Navy's Marine Mammal System (MMS). Four bottle-nosed dolphins have been trained to work in conjunction with two men on an improvised 15-foot, low-observable craft manned by a dolphin handler and a coxswain/navigator. This pairing of dolphins and divers has dramatically shown that relatively high-speed coverage of large areas is possible with good detection and location rates. Yet, the VSW MCM concept of operations does not advocate "man- and dolphin-in-the-loop" systems as the desired approach to mine countermeasures in the VSW zone. MMSs are aimed at increasing the effectiveness and survivability of current in-service systems until unmanned systems, equipment and tactical developments are introduced to the fleet.

Currently, acquisition programs are working to transition diver and marine mammal platoons from a prototype to operational status over the next two years. This transition will enable the necessary acquisition efforts to achieve an initial, advanced force VSW reconnaissance capability.

The VSW MCM concept of operations for development and employment of this small naval detachment is presently responsible for evaluation of prototype equipment, and is assigned a contingency deployment responsibility for operations within the next two years. In this sense, the VSW MCM detachment serves as a warfighting laboratory to assist the Navy's long-term objective of acquisition, research and development of unmanned, organic VSW MCM systems for deployment with battle groups.

Favorable Results

Recently, considerable data has been collected and analyzed with favorable results in mine reacquisition identification, mine searching and mapping by MMS against threat mine shapes in the VSW zone. The demonstrations showed that divers can navigate to a precise point and reacquire objects within short range of those points with a high degree of reliability using an acoustic grid-baseline navigation system and a short range "homing" sonar system. They also can positively identify mines and obstacles by type, and if necessary, place an explosive charge set for command actuation at a later time.

The demonstrations also showed that divers possess a limited capability to reliably search small areas to determine the presence or absence and type of mines. Incidental to search and reacquisition tasks, divers can map the area covered with hydrographic data and provide this information to the task force commander to aid in decision-making. Marine mammals can conduct mine search, mapping and classification at higher search rates than divers, and in high confidence. Searching several assault lanes in a single mission, even in difficult acoustic environments, also was demonstrated. The two systems (divers and dolphins) used in conjunction can accomplish the full range of tasks from search through identification. Key limitations of the systems are endurance (particularly in cold-water environments) and vulnerability of "man-in-the-loop" systems from hostile forces.

"....the very shallow water region is a critical point for our offensive forces and can easily, quickly and cheaply be exploited by the enemy. The magnitude of the current deficiency in reconnaissance and neutralization in these regions and the impact on amphibious assault operations were demonstrated during Operation Desert Storm."

Maj. Gen. Edward J. Hanlon Jr.
Director of Expeditionary Warfare
Sea Power, May 1997

Environments

Currently, the Navy strives to identify clear lanes (or to clear them) from the sea, through the VSW and surf zones (sz), to objective areas. The slope of the sea floor is a primary determinant of the length of the VSW and surf zones. For example, a 20-degree slope will result in a VSW/SZ lane (high water out to 40-foot depth curve) that is less than 65 yards long. On the other hand, a quarter-degree slope will result in a VSW/SZ lane that is over 3,000 yards long. The standard VSW/SZ lane for advanced force/pre-assault MCM training and exercises is 100 yards wide by 2,500 yards long (0.06 square nautical miles or 250,000 square yards).

The VSW and SZ environments are similar in many aspects, however; there are differences that have resulted in the evolution of various tactical approaches. Small, moored contact mines and bottom influence mines are typically spaced farther apart than obstacle and anti-tank mines in the shallow portions of the surf zone. Anti-invasion mines also may be found, stretching VSW MCM detachment capabilities into the surf zone as far inland as possible.

The ability of the enemy to seed the surf zone with mines and obstacles from shore without waterborne craft and the effects of tidal/wave action on the burial, unearthing and migration of SZ mines make it difficult to pinpoint mines and obstacles in advanced force operations. Today, overhead airborne sensors offer the potential for detecting beach and surf zone mine and obstacle fields/belts in large-area reconnaissance missions. Using overhead reconnaissance along a coastline has the benefit of not compromising potentially precise landing points. These reconnaissance tasks, coupled with in-stride breaching systems, offer the most practical approach available today for amphibious MCM in the surf zone. Accordingly, advanced development of line/net charge systems that can be delivered from amphibious craft is underway to improve on current in-service systems. Large obstacles (natural or man-made) and blast-resistant anti-tank/personnel mines may, however, require other approaches. Unfortunately, SZ approaches described above are not practical in many VSW environments. Breaching mines is not practical without enormous quantities of explosive charges. Detection of sea mines on (or beneath) the seabed in the VSW zone using "out-of-the-water" sensors is equally impractical in most environments. For this reason, "in-water" advanced force reconnaissance (and clearance) of mines in the lanes is the most effective MCM approach today. The Navy marine mammals are the only asset in the fleet that can detect buried mines.

Valuable Tool

The VSW MCM detachment is *not* intended as a stand-alone capability for the identification of mine-free lanes or the clearance of mined lanes in support of amphibious operations. Rather, it is a tool in the Amphibious Ready Group toolbag to support MCM operations from blue water into the objective area. The VSW MCM detachment must integrate and coordinate with the MCM task group to effectively insert into the objective area, accomplish their tasks and then extract. Search rate and endurance limitations of VSW MCM forces require using all other available information (e.g., human intelligence, area surveillance information, overhead sensor reconnaissance etc.)

As the VSW MCM detachment develops its tactics, subsystems must be developed and refined to determine:

- how assets will insert from over the horizon into the objective area,

- how MCM tasks will be accomplished in the objective area and
- how assets will extract from the objective area back to their host platform.

To accomplish their mission, diver and marine mammal platoons use precise underwater navigation systems, Underwater Breathing Apparatus (UBA), underwater object detection, classification and identification systems, command, control and communications (C3) systems, diver propulsion systems, mine and obstacle marker systems and mine and obstacle neutralization/disposal systems.

Given the limited payload capability of diver, marine mammal and Unmanned Undersea Vehicle (UUV) systems, size and portability of subsystems remains a key issue. Shipboard footprint is also an important consideration in the development of diver, dolphin and unmanned platform systems. Shipboard real estate for advanced force and pre-assault MCM tasks is extremely limited given the need to maximize space for assault forces. Accordingly, VSW MCM platoons are structured with a small footprint.

In the near term, technology development that improves the effectiveness and/or safety of diver/marine mammal systems in the sub-tasks specified above are of considerable interest, especially those which are readily adaptable to emerging UUV platform technologies. In the near and midterm, organic, platform-based systems are expected to reduce the necessity for divers and marine mammals in these complex and dangerous operations. Eventually, these systems will provide the basis for a new paradigm in organic MCM, to accomplish clandestine reconnaissance and in-stride clearance in the Very Shallow Water and Surf Zone regimes.

Editor's note: Cmdr. Dan Renwick is the VSW coordinator in the office of the Director for Expeditionary Warfare (OPNAV N85).

Marine Mammal Systems

by Cmdr. Dan Renwick

The Navy has one prototype and four operational Marine Mammal Systems (MMSs) managed by the special operations community. Composed of specially trained bottle-nosed dolphins, utilizing their natural echolocation capabilities, and sea lions, with their low light vision and sensitive hearing, these animals have efficiently met selected fleet requirements. The Navy will continue to use these mammals until hardware systems become available to replace them.

Marine mammals can conduct mine search, mapping and classification at higher search rates than divers, and in high confidence. *(Stephen Batiz/USN)*

There are four types of Marine Mammal Systems utilized by the fleet and one under development:

- The Mk 4 MMS employs four dolphins for close-tethered, deep-moored mine hunting and neutralization. The Navy employs this capability to neutralize all buoyant mines.
- The Mk 5 MMS employs four sea lions for pingered object recovery. Sea lions attach recovery pendants to exercise mines, torpedoes and other test objects equipped with acoustic pingers at depths of 500 feet.
- The Mk 6 MMS employs six dolphins for swimmer and diver detection and defense of harbors, anchorages and individual ships.
- The Mk 7 MMS employs eight dolphins for mine detection, classification, location and neutralization of proud and buried bottom mines. The Mk 7 MMS is the Navy's only operational buried mine detection and neutralization capability.
- The Ex 8 MMS will employ six dolphins for exploration and reconnaissance of in-volume moored and bottom mine-like contacts in the Very Shallow Water (VSW) zone.

The Mk 6 MMS employs six dolphins to provide the Navy with a fly-away waterside security system that protects high value targets in harbors, anchorages and individual assets against underwater-borne intruders. The Mk 6 MMS was operationally deployed to Cam Rahn Bay, Vietnam in 1970, to Bahrain during Earnest Will in 1988 and most recently, to Pohang, Korea in Freedom Banner 95. This rapidly deployable system provides the Navy with its only comprehensive surface and subsurface swimmer detection and response capability into the 21st century.

The Ex 8 MMS will employ 4 dolphins for exploration and reconnaissance of in-volume moored and bottom mine-like contacts in the VSW zone. The Ex 8 will be deployable from an Amphibious Task Force ship for low-visibility, VSW minefield exploration and reconnaissance.

SITREP

New Master Chief Petty Officer of the Navy Assumes Duties

MMCM(SS/SW/AW) Jim Herdt assumed the duties as Master Chief Petty Officer of the Navy (MCPON) in recent ceremonies at the Washington Navy Yard.

Chief of Naval Operations, Adm. Jay L. Johnson, issued the appointment for Herdt to succeed MCPON ETCM(SW) John Hagan as the ninth MCPON.

"As I embark on that mission (as MCPON), I am thankful for many fundamentals of Navy life that will guide me through this magnificent opportunity to serve," Herdt said. "I am thankful for the teaching, mentoring and guidance I have received from all of the chiefs, officers and commanding officers I've served with for all these years. They often had more confidence in me than I had in myself and they taught me well."

The ceremony also marked the retirement of Hagan after more than five and one-half years as MCPON and more than 33 years of active duty.

"He has been a trusted counselor, a close friend, and more importantly, a man who tells the unvarnished truth whenever he speaks," Johnson said of Hagan. "He knows what it's like to balance the demands of a challenging career, the pursuit of higher education and a family on a Sailor's paycheck. And he knows how good it feels when the voyage is over, and the arms of his family await."

Hagan pointed with great pride at the qualities of the Navy's chief petty officer community. "The Chief's Mess owns many responsibilities, one of the most important among them is to be the guardians and teachers of our heritage and traditions," Hagan said as he offered support for Herdt. "Lead the Chiefs, they will lead the crew and we will not fail. Your success is certain, only the details are unknown."

MMCM(SS/SW/AW) Jim Herdt

Johnson awarded Hagan the Navy's highest non-combat award, the Navy Distinguished Service Medal. The award citation noted that Hagan demonstrated boundless energy, sound logic and inspirational leadership by traveling around the globe to visit Sailors ashore and at sea in order to effectively address their needs and desires to top Congressional and military policy makers. Additionally, while serving on several military and civilian boards and committees, his keen insight and judgment played a vital role in utilizing minimal fiscal and material resources to effectively implement policies and programs which positively affected the readiness and morale of the Navy's enlisted community.

Cathy Hagan was also recognized for her work as the Navy's Ombudsman-at-Large. She was awarded the Distinguished Public Service Award for her invaluable assistance in identifying and addressing many issues and concerns of Navy families. Her sincere commitment and dedication to Navy families, coupled with her extensive knowledge and 33 years experience as a Navy wife, were instrumental in correcting numerous misconceptions and anxieties regarding morale, welfare and family issues in relation to Navy policies. — *Navy Wire Service*

A Message From SECNAV: The Year 2000 Challenge

The purpose of this message is to emphasize the importance of the "Year 2000" challenges ahead of us. This issue is one of our highest priorities. It is of utmost importance that we preserve our full warfighting capability by insuring that no mission-critical system in the air, at sea or ashore fails because of Year 2000 (Y2K) problems.

As we approach the 21st century, we are relying more heavily each year on information technology and automation to carry out our worldwide missions. One of the greatest information technology challenges facing the Department of the Navy (DON) and the industrial world is the Y2K problem. The problem arises from the widespread practice of using two digits vice four digits to represent the year in computer databases, software applications and hardware chips. Y2K-related difficulties will arise at the turn of the century if our information technology equipment cannot differentiate the year 2000 from the year 1900.

I expect full involvement of our naval leadership in Y2K issues. We cannot afford to approach this problem with a business as usual attitude. The Y2K problem is not just an information technology problem but one that touches virtually all areas of the Navy/Marine Corps team from the foxhole, to the flightline, to the destroyer deckplate, to the shore infrastructure that supports our forces. It is a pervasive problem and we must be prepared.

My goal is to have all mission-critical systems fixed and deployed to the fleet no later than Dec. 31, 1998. This will allow us one full year for integrated testing of our systems in an operational environment. Guidance on the department's approach to the millennium and critical milestones is contained in the DON Y2K action plan at the chief information officer's web site **(http://www.doncio.navy.mil/y2k/year2000.htm).**

Additional guidance will be provided periodically from the Chief of Naval Operations and the Commandant of the Marine Corps as necessary. — *Secretary of The Navy John H. Dalton, Navy Wire Service*

Establishment of the Maritime Battle Center

Chief of Naval Operations, Adm. Jay L. Johnson, recently announced the establishment of a Maritime Battle Center (MBC) at the Naval War College (NWC) in Newport, R.I.

The MBC will be responsible for designing and planning fleet battle experiments, coordinating the execution of battle experiments in conjunction with the fleet and analyzing and disseminating experiment results. These results will be used to update Navy doctrine and tactical training publications, accelerate the delivery of innovative warfare capabilities to the fleet, identify concept-based requirements and evaluate new operational capabilities.

The MBC will serve as the single point of contact for Navy fleet battle experimentation and will coordinate Navy participation in joint experimentation projects.

The MBC eventually will be part of a new command, the Navy Warfare Development Command (NWDC), which will be stood up over the next several months and report to the president of the NWC.

This architecture will merge the Navy's warfare concept development, fleet experimentation and doctrine refinement efforts under a single command. Collocating the NWDC with the NWC will provide a powerful synergy for innovative thinking that will serve as the foundation of future operational success. — *Navy Wire Service*

USS Guam Helps Croatian Mariners

As USS **Guam** (LPH 9) crossed the Atlantic Ocean heading home to Norfolk March 25, it received a distress call from a Croatian bulk carrier requesting medical assistance for two mariners.

One mariner complained of severe abdominal pains and another was suffering from an irregular heartbeat. The vessel was approximately 350 miles from the **Guam**.

Staff members of embarked Amphibious Squadron (PHIBRON) Two talked to the master of the ship and arranged a rendezvous to transfer the patients. An aircraft from Helicopter Support Squadron 6 Detachment 3 embarked in **Guam** was launched to medically evacuate the patients to the **Guam** for evaluation and treatment.

"Usually when we come in to do any type of live hoisting, we're about 10 feet over the deck," said Aviation Structural Mechanic (Structures) 3rd Class Christopher Cervantes. Because of the design of the Croation ship, outfitted with several 30- to 40-foot cranes on the weather deck, the helicopter was forced to hover about 75 feet above the deck.

"We're not used to hoisting up from that height. It's hard to judge the distance," said Cervantes, a Los Angeles native. "The deck was pitching and rolling a lot too, so that played a big factor."

Operating in five- to seven-foot seas was a challenge for Aviation Electronics Technician 3rd Class Kurt Violette, who was lowered to the vessel to prepare the patients for hoisting to the helicopter.

"As I was approaching the deck, I was swinging back and forth almost going over the water and towards the superstructure," said Violette, a Waterbury, Conn. Native. "But I got down there safe and sound and started preparing the passenger for his hoist up to the aircraft."

Both men were safely airlifted to the **Guam** and were treated by medical personnel. — *JOC Doug Hummel, USS Guam Public Affairs*

An extraordinary rescue by a LAMPS crew *(USN)*

Navy Helicopter Rescues Six From Burning Tower

A Navy helicopter crew from Naval Station Mayport, Fla., rescued six workers from inside a burning tower March 25 in Palatka, Fla., 35 miles southwest of Jacksonville.

Responding to an emergency call from the local fire department, Helicopter Anti-Submarine Squadron Light (HSL) 40 launched two SH-60B Seahawk helicopters. The first aircraft on the scene rescued six stranded utility workers from a burning smoke stack at the Palatka Seminole Electric Plant while the second helicopter coordinated communications with the base.

With Lt. Drew Kransy hovering the helo 650 feet above the ground, his aircrew were lowered into the smoke stack by a hoisting device. Within 15 minutes, the stranded workers were lifted to safety aboard the helicopter.

"The workers were covered with soot and happy to be alive," said Kransy. "Our Search and Rescue crews are trained to perform rescue missions over *water*, not smoke stacks. However, they're also trained to adapt to any situation." — *CINCLANTFLT Public Affairs*

Changes of Command

March/April

SURFLANT

Commander, Destroyer Squadron 24
Capt. William D. Crowder relieved
Capt. Richard P. Foster

MCM Rotational Crew Delta
Lt. Cmdr. Humberto L. Quintanilla relieved
Lt. Cmdr. Michael L. Arture

USS ***Arleigh Burke*** (DDG 51)
Cmdr. Nevin P. Carr relieved
Cmdr. Mark E. Kosnik

USS ***Carr*** (FFG 52)
Cmdr. Michael W. Reedy relieved
Cmdr. Keith L. Wray

USS ***Deyo*** (DD 989)
Cmdr. Stephen J. Johnson relieved
Cmdr. Daniel S. Beach

USS ***Falcon*** (MHC 59)
Lt. Cmdr. Robert P. Irelan relieved
Lt. Cmdr. Peter J. Fanta

USS ***Grapple*** (ARS 53)
Lt. Cmdr. David Davis relieved
Lt. Cmdr. William T. Robertson

USS ***Kauffman*** (FFG 59)
Cmdr. George J. Karol relieved
Cmdr. John A. Kunert

USS ***Leyte Gulf*** (CG 55)
Capt. Raymond P. Donahue relieved
Capt. Charles S. Vogan

USS ***Nashville*** (LPD 13)
Capt. Eric C. Neidlinger relieved
Capt. William L. McKee

USS ***Philippine Sea*** (CG 58)
Capt. Robert D. Jenkins III relieved
Capt. James L. McClane

USS ***Platte*** (AO 186)
Cmdr. Donna M. Looney relieved
Cmdr. Beulah C. Galvin

USS ***Supply*** (AOE 6)
Capt. Joe N. Stafford relieved
Capt. David R. Bryant

USS ***Whidbey Island*** (LSD 41)
Cmdr. Ray L. Clark relieved
Cmdr. Terry C. Pierce

SURFPAC

Assault Craft Unit 1
Cmdr. Thomas S. Wetherald relieved
Cmdr. James L. Warren

Commander, Amphibious Squadron 1
Capt. William F. Hopper relieved
Capt. Stephen E. Donlon

Commander, Destroyer Squadron 9
Capt. John C. Meyer relieved
Capt Michael E. Duffy

Commander, Destroyer Squadron 21
Capt. James Stavridis relieved
Capt. Patrick J. Slattery

Consolidated Divers Unit
Cmdr. Debra A. Bodenstedt relieved
Lt. Cmdr. Troy C. Pappas

Commander, Explosive Ordnance Disposal Group 1
Capt. Rollin G. Lippert relieved
Capt. Thomas R. Bernitt

USS ***Boxer*** (LHD 4)
Cmdr. Edward L. Brownlee relieved
Capt. James K. Moran

USS ***David R. Ray*** (DD 971)
Cmdr. Richard D. Fitzpatrick relieved
Cmdr. William E. Dewes

USS ***Gary*** (FFG 51)
Cmdr. Joseph C. Harris relieved
Cmdr. Andrew L. Diefenbach

USS ***Oldendorf*** (DD 972)
Cmdr. Donald E. Babcock relieved
Cmdr. Rolf A. Yngve

1998 Surface Warfare Photo Contest

Surface Warfare Magazine and the Surface Navy Association (SNA) are proud to announce the 1998 Photography Contest. *Surface Warfare* will publish the winning photographs. Cash prizes will be awarded as follows:

First Prize	**$500**
Second Prize	$250
Third Prize	$200
Honorable Mention (1)	$50

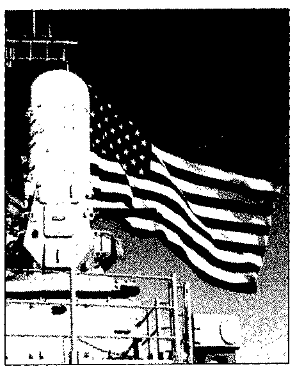
Entry Rules:

1. **Purpose:** This contest is designed to pictorially represent the professional activities and life of the diverse elements of the Surface Warfare community and their contributions to naval warfare and the Nation. Each photograph must be *directly* related to Surface Warfare (i.e. underway/waterfront operations; ships; personnel; training; weapons firings; recreation).
2. **Eligibility:** Photo submissions will be accepted from any officer or enlisted person in the U.S. Uniformed Services (active, reserve or retired), or civilian employees thereof — including civilian contractors. A limit of three entries per person is requested. The recipient of an award must be the person who took the photograph.
3. **Criteria:** Entries must be either black-and-white prints, color prints, or color transparencies. Minimum print size is 5x7. Minimum transparency size is 35mm. Photos should be recent. Full captions, photographer's name, address and unit must be attached to each entry.
4. **Submissions:** Address entry packages to:

SWM/SNA 1998 Photo Contest
c/o Surface Warfare Magazine
2211 South Clark Place, Suite 120
Arlington, VA 22202-3704

Entries must be received by Sept. 15 1998. Only photographs accompanied by a stamped, self-addressed envelope will be returned. *Winning* photos and all *other* entries become the property of the Surface Navy Association and *Surface Warfare*.

5. **Awards:** SNA will announce the winners by news release in December 1998 and publication of winning entries in the January/February 1999 issue of *Surface Warfare*. SNA will award prizes during the annual Surface Navy Association Symposium held in Washington, D.C. in January 1999.
6. **Information:** For further details, contact *Surface Warfare* at: (703) 602-7823 or DSN 332-7823.



(Calvin L. Cairns)

Naval War College Offering Nonresident Seminar

The College of Continuing Education (CCE) of the Naval War College (NWC) will offer its Nonresident Seminar Program in 19 locations beginning in September. CCE seminar students who complete the three core courses of Strategy and Policy, National Security Decision Making, and Joint Maritime Operations will receive a Naval War College diploma and Joint Professional Military Education (JPME) Phase I certification.

Nonresident seminars are led by NWC adjunct faculty members augmented by visiting NWC lecturers. The seminars provide an educational experience similar in both content and atmosphere to the resident course of study. Nonresident Seminar courses are designed to focus student thought on the enduring principles of war and peace, and the recurring themes which arise from the study of conflict. The seminars also address the challenges of joint-force operations, and they promote lively debate on current issues within the national security environment.

NWC and its Nonresident Seminar Program have been accredited by the New England Association of Schools and Colleges, and many universities will accept transfer credit up to 20 graduate-level credit-hours for the three courses. Seminars will be offered for the 1998-9 academic year in:

Annapolis, Md.; Athens, Ga.; Dahlgren, Va.; Everett, Wash.; Ft. Meade, Md.; Great Lakes, Ill.; Jacksonville, Fla.; Kings Bay, Ga.; Mechanicsburg, Penn.; Monterey, Calif.; New Orleans, La.; Newport, R.I.; Norfolk, Va.; Patuxent River, Md.; Peal Harbor, Hawaii; Pensacola, Fla.; San Diego, Calif.; Washington, D.C.; and Naples, Italy.

NWC accepts Nonresident Seminar Program applications from commissioned officers and DOD civilian employees. Members of the sea services must be grade O-3 or above, and officers from other services must be grade O-4 or above. DOD civilians in the grade of GS-11 or above also are eligible. Courses are offered at no cost to the participants, and all course materials are provided on a loan basis.

To obtain a Nonresident Program Information Guide, which provides detailed information regarding enrollment procedures and an application, call the Naval War College at (401) 841-6519, DSN: 948-6519 or via e-mail at CCENRS@USNWC.EDU.

Surface Warfare

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Surface Warfare is the professional magazine of the surface warfare community. Its mission is to further the objectives of the Chief of Naval Operations by disseminating information to the surface warfare community which will increase professionalism, improve readiness and sustainability, augment retention and enhance a sense of common identity and esprit. The opinions and assertions herein are the personal ones of the authors and do not necessarily reflect the official views of the U.S. government, the Department of Defense or the Department of the Navy.

***Surface Warfare* (USPS 104-170)** ISSN 0145-1073) is published bimonthly from appropriated funds by authority of the Chief of Naval Operations in accordance with NPPR P-35. The Secretary of the Navy has determined that this publication is necessary in the transaction of business required by law of the Department of the Navy. Use of funds for printing this publication has been approved by the Navy Publications and Printing Policy Committee. Reproductions are encouraged. Controlled circulation. Periodicals postage paid at Arlington, VA and additional mailing offices.

Postmaster: Send address changes to address below.

Surface Warfare Magazine
Crystal Plaza 5, Suite 120
2211 South Clark Place
Arlington, VA 22202-3704

Editorial: Address editorial inquiries to:

Phone: (703) 602-7823
DSN: 332-7823
FAX: (703) 602-7822

SURFWARMAG@HQ.NAVSEA.NAVY.MIL

Subscriptions: Personal (paid)
Government Printing Office
Washington D.C. 20402
(202) 512-1800

Institutional (free/controlled):
Contact editorial offices
for subscription/address changes

Printed in the United States

On Station

As of late April

Arabian Gulf

USS ***Ardent*** (MCM 12)
USS ***Barry*** (DDG 52)
USS ***Briscoe*** (DD 977)
USS ***Bunker Hill*** (CG 52)
USNS ***Catawba*** (TATF 168)
USS ***Cole*** (DDG 67)
USS ***Denver*** (LPD 9)
USS ***Dextrous*** (MCM 13)
USNS ***Gilliland*** (TAKR 298)
USNS ***Gordon*** (TAKR 296)
USNS ***Guadalupe*** (TAO 200)
USS ***Independence*** (CV 62)
USS ***John C. Stennis*** (CVN 74)
USS ***John S. McCain*** (DDG 56)
USNS ***Kilauea*** (TAE 26)
USS ***Mount Vernon*** (LSD 39)
USNS ***Patuxent*** (TAO 201)
USS ***Samuel B. Roberts*** (FFG 58)
USS ***San Jacinto*** (CG 56)
USNS ***Santa Barbara*** (TAE 28)
USNS ***Saturn*** (TAFS 10)
USNS ***Shugart*** (TAKR 295)
USS ***Simon Lake*** (AS 33)
USS ***Tarawa*** (LHA 1)
USNS ***Walter S. Diehl*** (TAO 193)
USNS ***Yano*** (TAKR 297)

Atlantic

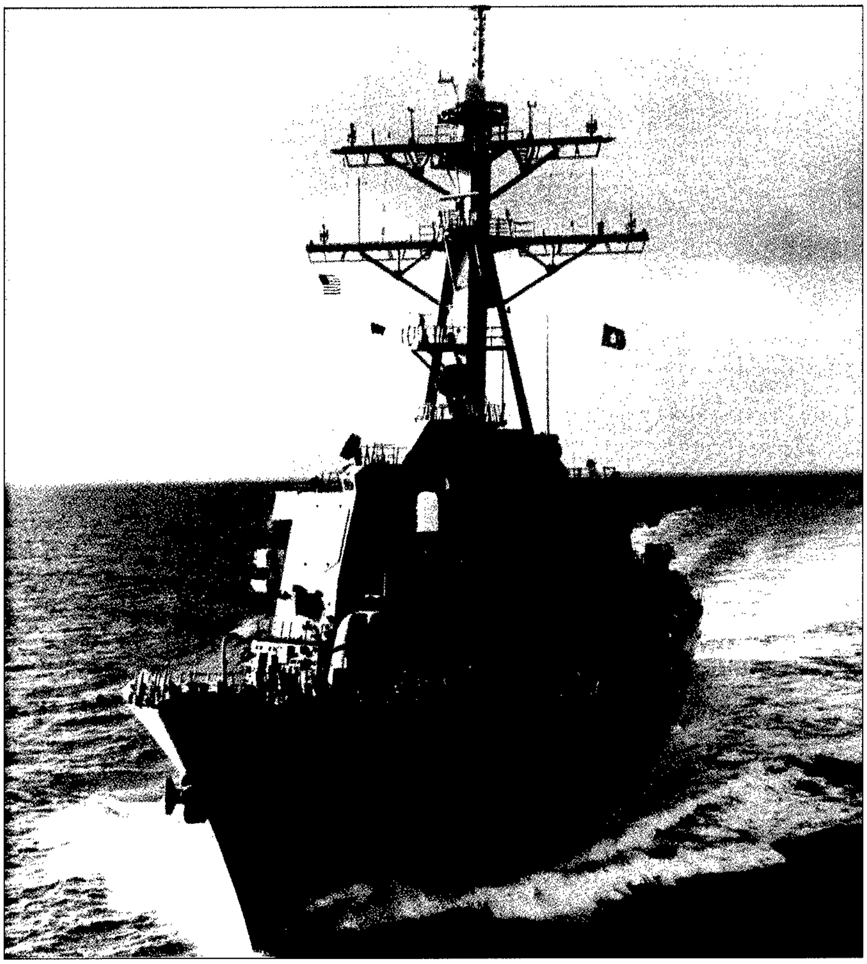
USS ***Robert G. Bradley*** (FFG 49)

Caribbean

USS ***California*** (CGN 36)
USS ***Conolly*** (DD 979)
USS ***Scott*** (DDG 995)

Mediterranean

USNS ***Big Horn*** (TAO 198)
USS ***Caron*** (DD 970)
USNS ***Concord*** (TAFS 5)
USS ***Grasp*** (ARS 51)
USS ***Kauffman*** (FFG 59)
USS ***Laboon*** (DDG 58)
USNS ***Laramie*** (TAO 203)
USS ***La Salle*** (AGF 3)
USS ***Merrimack*** (AO 179)
USS ***Portland*** (LSD 37)
USS ***Simpson*** (FFG 56)
USS ***Trenton*** (LPD 14)
USS ***Typhoon*** (PC 5)
USS ***Wasp*** (LHD 1)



USS *Curtis Wilbur* (DDG 54) *(Debbie Huston/BIW)*

Pacific

USS ***Belleau Wood*** (LHA 3)
USS ***Blue Ridge*** (LCC 19)
USS ***Crommelin*** (FFG 37)
USS ***Curtis Wilbur*** (DDG 54)
USS ***Cushing*** (DD 985)
USS ***Dubuque*** (LPD 8)
USS ***Fife*** (DD 991)
USS ***Fort McHenry*** (LSD 43)
USS ***Frank Cable*** (AS 40)
USS ***George Philip*** (FFG 12)
USS ***Germantown*** (LSD 42)
USS ***Guardian*** (MCM 5)
USS ***John Young*** (DD 973)
USS ***Ingersoll*** (DD 990)
USS ***Mobile Bay*** (CG 53)
USNS ***Narragansett*** (TATF 167)
USNS ***Niagara Falls*** (TAFS 3)
USS ***O'Brien*** (DD 975)
USS ***Patriot*** (MCM 7)
USS ***Reuben James*** (FFG 57)
USS ***Rodney M. Davis*** (FFG 60)
USS ***Russell*** (DDG 59)
USS ***Sacramento*** (AOE 1)
USNS ***San Jose*** (TAFS 7)
USNS ***Spica*** (TAFS 9)
USS ***Thach*** (FFG 43)
USNS ***Tippecanoe*** (TAO 199)
USS ***Vandegrift*** (FFG 48)
USS ***Vincennes*** (CG 49)
USNS ***Yukon*** (TAO 202)